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MONDAY, FEBRUARY 23, 1976

The hearing reconvened at 1:35 P.M. on Monday, February 23, 1976, in the Chambers of the Montana House of Representatives, State Capitol, Helena, Montana.

The Honorable Carl M. Davis, Hearings Examiner, presided over the proceedings.

APPEARANCES:

Applicants:

William M. Bellingham, Esq.
John L. Peterson, Esq.
John Ross, Esq.

Department of Natural Resources and Conservation:

Arden E. Shenker, Esq.
Ted J. Doney, Esq.
Donald MacIntyre, Esq.

The following proceedings were had:

HEARINGS EXAMINER: Are the parties ready to proceed?

MR. BELLINGHAM: Applicants are ready, sir.

MR. SHENKER: The Department of Natural Resources is ready.

HEARINGS EXAMINER: Before we start, the Northern Plains Resource Council would like the record to show they have served eleven written statements: Ted Flynn, Dick Golden, Tom Peccia, Paul Bruner, Jim Snyden, Dr. Ryan Sinclair, Knute Hanson, Bill Gillen, Jed Stanfield, Frank Munshower and Bob Conley. The first witness this afternoon will be Mr. Barrett.

FRED BARRETT, called as a witness by the Department of Natural Resources, having been first duly sworn upon his oath, both as to his written direct testimony and as to the oral testimony to follow, was examined and testified as follows:

(THE WRITTEN DIRECT TESTIMONY OF MR. FRED BARRETT WAS DIRECTED TO BE INSERTED AT THIS POINT.)

STATE OF TESTIMONY

OF

FRED BARRETT

My name is Fred Barrett. I reside in Helena, Montana. I am a graduate of the University of Montana and have served as a member of the Montana State Legislature for five sessions. I was a legislative liason officer for the Governor in the 1971 session.

I was appointed Administrator of the Employment Security Division of the Department of Labor and Industry and have served in that capacity since 1971. The Employment Security Division is the state agency responsible for administering the Unemployment Compensation Program and the Public Employment Service. Chartered under the Wagner Peyser Act, the Employment Service has among other major responsibilities, that of maintaining statistical records of total employment, unemployment, wage and hour information, in fact all data which go into the sum total of labor market information for the State. In cooperation with the Bureau of Labor Statistics, the Employment Service is the sole source agency for most of the labor market information which serves as a basis for state and national official unemployment and employment and training programs, economic development grants, and most other similar programs where labor market information is the basis for such allocation. Most economic forecasts rely in good measure on the information available through the Research and Statistical Section of the Employment Security Division. Much of the data in my statement was compiled by the Research and Analysis Section of the Employment Security Division, which is currently supervised by Dave Folsom, who in turn is under my supervision and control and who reports to me regarding the operation and administration of the Research and Analysis Section.

The impact of employment for the proposed Colstrip Units 3 and 4 will provide significant economic stimuli in the local area, speaking generally of Southeastern Montana, but these economic stimuli weaken as the distance from the area increases. Employment opportunities also will be created by the construction and operation of Units 3 and 4. Areas away from the proposed location may be affected, but these will be highly specialized cases and will not necessarily create other derivative employment. An example of this may be the addition of a few employees in the wholesale industry in Billings to help meet the retail needs in Forsyth, or the building of steam-powered boilers in another state ot meet the requirements of Units 3 and 4. Industries most likely to be affected are of course, mining and utilities as well as the railroad transportation, wholesale and retail trade and service industries. The effects of Units 3 and 4 on other industries not directly related will be minimal if at all. An example of this would be the wood products industry. An increase in housing demands for the workers and operators at Units 3 and 4 would not be significantly noticeable to the industry. A national economic stimuli is needed to reverse present trends in the wood products industry. The occupational structure of power generation is not comparable to the wood products industry and would not be an occupational competition for workers.

Another important factor to consider is that the layoffs in the wood products industry have already exceeded the expected potential employment for the operation of Units 3 and 4, and the anticipated layoffs in the copper mining industry will offset any growth in strip-mining employment. Temporary adverse economic conditions will also result from the construction of Units 3 and 4 in that substantial numbers of unemployed persons will migrate to the area during construction, causing a disproportionate imbalance of supply and demand as has been the case for other major construction projects, i.e., the Libby Dam, Minuteman Missiles, and the Alaskan Pipeline. It must be noted that this situation is normal and will taper off as the project nears completion. Typically, the unemployed will venture to this area from outside the state as well as relocating within the state. This will place a strain on available human resource services such as employment service functions, unemployment compensation, and welfare agencies.

It is expected that most professional, technical, and management people necessary to operate the power plants will be effects and cannot be judged as all good or all bad. In summary, employment increases will be primarily in the local area of the proposed units, but Billings and Southeastern Montana will undoubtedly benefit in terms of personal income and business growth. Montana as a whole will benefit in terms of increased tax revenues and a fairly stable small addition to our economy. However, this proposed project will not solve the economic situation presently facing the State and the Nation.

When considering the construction force required to complete Colstrip Units 3 and 4, it must be noted that this construction force is not autonomous from the construction force working on Colstrip Units 1 and 2. That is, many of the same workers will be involved in both projects. The principles of economies of scale would apply to the general contractor if construction were simultaneous between the two projects or any fraction thereof, assuming the same general contractor.

In constructing a power generation plant there are usually three phases of construction. The strip-mine, the power generation plant, and transmission lines. Additional construction workers may also be required to build highways and lay track. For our purposes we will only discuss the construction force to build the plant and erect transmission lines.

In constructing a power generation plant, a construction force of approximately 3.75 man-years per MW (megawatt) is needed to build a 500 MW plant. The number of man-years needed for completion would total 1,875 and would be completed in three years, utilizing 25% of the man-years the first year, 50% the second year, and the remaining 25% the third year. Construction of power transmission lines of 500 KV (Kilovolt) is estimated at 40 construction workers at the rate of two miles per month.

HEARINGS EXAMINER: Please be seated, Mr. Barrett. Mr. Bellingham may cross-examine.

MR. SHENKER: Mr. Davis, let the record show that the Department of Natural Resources and Conservation tenders the testimony of Fred Barrett, and there are no exhibits that are offered in connection with that testimony.

HEARINGS EXAMINER: Very well. Thank you, Mr. Shenker.

EXAMINATION OF FRED BARRETT

Cross, by Applicants

By Mr. Bellingham:

Q Your face looks very familiar, Mr. Barrett. It seems to me back in the deep, dark ages, you and I went to school together; did we not?

A Yes, I think we did, Bill.

Q I won't ask you how many years ago it was. It would embarrass both of us.

A Right.

Q Let's turn to your statement, Mr. Barrett, to page 2. You say that, "Employment opportunities also will be created by the construction and operation of units 3 and 4." Do you have any idea how many jobs will be created by 3 and 4 if it is finally approved and built?

A We have made some estimates based upon our own assumptions using the ordinary method of projecting manpower and employment opportunities. And so, yes, we do have some estimates.

Q What do you have?

A I think the -- in the year 1977, considering the fact that unit 2 would not be completed yet and having a partial work force there, plus whatever construction would start on 3 and 4, if it started in 1977, we could have a peak employment of perhaps 2500-2600; and I think in my statement I estimated that an average employment of popular job opportunities at about 1800. That's in the construction phase.

Q Now, as far as permanent employees upon units 3 and 4, do you have a figure for that?

A We have an estimate of the number of employees after construction and to operate the plants, and -- let me find my figures here -- as I recall, it was about 126 for each, figuring Colstrip 3 and 4 would each have a permanent operating staff of about 126 workers.

Q That would be 352 total, permanent workers working on 3 and 4?

A If my addition is correct, it would be 252.

Q I'm just a hundred off is all -- 252. Did you get any of your figures from the prime contractor on the job, Bechtel, or from anyone else; or were these figures arrived at as a result of calculations in your own office?

A Both. We used the same methodology which is acceptable in projecting employment and numbers of workers in similar types of operation and we have access to all of the current figures, not only of Bechtel, but of Montana Power and all the other companies; in fact, any business doing business in Montana submits to us, by law, the required statistics on wages, hours, types of jobs, and so forth. So it would be a combination of that type of thing, and using accepted methodology, arriving at that number of people.

Q Well, I might inform you that according to an exhibit, Applicants Exhibit 25, taken from Bechtel records, in 1977 they show 353 people working on 3 and 4 temporary construction, none on 1 and 2, with a total of around 1,505 in 1975. I assume those figures are correct?

A 1975?

Q 1979.

A Right. I was aware of those figures, Bill. And, of course, Bechtel and you know more precisely than we do what the work schedule would be, should the construction start at any given time; so, naturally, you're in a much better position than we are to anticipate when you would be hiring people and when your peak work load would be.

Q I might also mention that as far as permanent employees upon units 3 and 4, according to their figures, they estimate that

99 total for both units will be necessary.

A I was also aware of that, and, again, if they found some methods that are new in cutting down the needed number of people to operate the plants, then that's so much the better for their business management.

Q Well, turning to page 3, you state there on line 2 that another important factor to consider is that the layoffs in the wood products industry have already exceeded the expected potential employment for the operation of units 3 and 4. I assume you're just drawing an analogy there; you're not attempting to intimate there that because the layoffs of the wood products industry has already exceeded its expected potential employment for the operation of units 3 and 4, that this is a valid reason why 3 and 4 should not be constructed; you're not inferring that, are you?

A We're not inferring that in any way, Bill. The reason that was put in was to put into proper perspective the numbers of people who would be anticipated to be employed in units 3 and 4, both during construction and during operation.

Q And I assume that the same answer is also true when you turn to line 5 on page 3: ". . the anticipated layoffs in the copper mining industry will offset any growth in strip-mining employment." You're not inferring there that that is a reason why we should not continue with strip-mining employment?

A Again, just to show the perspective of the employment or non-employment in one industry and the projected possible employment in another.

Q Now, calling your attention, Mr. Barrett, to line 6 on page 3, you say, "Temporary adverse economic conditions will also result from the construction of units 3 and 4 in that substantial numbers of unemployed persons will migrate to the area during construction, causing a disproportionate imbalance of supply and demand as has been the case for other major construction projects . ." What do you mean by that?

A I think the sentence in line 12, 13 and 14 explains that. "It must be noted that this situation is normal and will taper off as the project nears completion." This is the normal pattern of any large-scale construction project, from Fort Peck Dam to the ABM missile, to Colstrip 1 and 2 and 3 and 4; and it was pointed out to show the affects of construction as it attracts unemployed people into an area, and then, of course, as my statement goes on, a number of them become employed, some do not, or they may or may not stay in the area. And, of course, when the project is over, they go elsewhere.

Q Well, as a practical matter, as you say, it is typical that unemployed will come to this area. Some of them will get jobs, and they will then be off the rolls as unemployed personnel and be on the rolls as employed personnel; isn't that right?

A Those who get jobs there, absolutely.

Q This is typical. They'll be taken off of unemployment compensation, if they're already on it; and in that respect, it will be a social benefit?

A In that respect, yes.

Q Now, at line 19, you talk about people coming from outside of the state; do you know, now, of the total personnel that have been working upon 1 and 2, what percentage have been in-state and what percentage have been out-of-state residents?

A I don't have that information, no.

Q I think Mr. Waldon, in his previous testimony, indicated that approximately 65 percent were Montana residents and 35 percent were out-of-state residents; does that strike you as high or low or inbetween, or do you have any comments?

A I think that would probably be an accurate projection; well, I know it is if it's taken from actual figures, and probably is normal.

Q Figures then don't surprise you at all?

A No, I think it fits my statement.

Q Now, at line 27, you say, thus the affect of the new construction in all likelihood will not help to reduce the hard-core unemployed in the immediate area or throughout the state. It will help, however, though, won't it?

A No question; any employment of one individual helps that individual and helps to cut down unemployment.

Q I don't think you were present in the hearings room when Paul Polzin from the University of Montana gave testimony?

A No, I was not.

Q You're familiar with Mr. Polzin, I assume?

A Yes.

Q He indicated that as far as unemployment as a whole is concerned, it's going to take not one big development, because that isn't in the offing, but a series of small construction and other types of business developments to offset the unemployment; and I assume you agree with that, of course?

A Yes, I do.

Q And, units 3 and 4 and the construction of those units could well be one of those small items that go in the overall picture to help reduce unemployment; isn't that right?

A Well, if I understood your -- I think you misstated yourself, Mr. Bellingham.

Q In what way?

A I think you said it would help produce unemployment.

Q I was going to say, to reduce unemployment.

A Okay, I understood you. I would not argue with that at all.

Q You'd agree with that?

A Yes, I would.

Q And if I did use a word other than reduce, I didn't mean to.

A I misheard you, I guess.

Q Page 4, line 7, you say, the construction workers will overload the existing service facilities, causing these industries to expand their resources, including employment; and then you go on to the economic impasse, and so forth. Have you made a study of this, insofar as Colstrip 3 and 4 is concerned?

A No, because this has not occurred yet, for Colstrip 3 and 4.

Q Have you made a study of it insofar as units 1 and 2 are concerned?

A No, there again, it has only occurred partially.

Q Well, is it a function of your office to make economic studies of this kind?

A Yes, right.

Q And you have not made such a study?

A Well, not on these, but we have plenty of evidence in the files and plenty of study and statistics and numbers and anything you want on every construction project that has been completed and has caused this economic impasse that I talked about. The most glaring, of course, due to forces uncontrollable by anyone in this state, was the ABM missile site, during which workers and the communities experienced one of the most tremendous burdens because of the great number of unemployed suddenly cast adrift in their areas.

Q After the construction?

A Yes, and that's what I'm referring to in this statement.

Q Well, have steps been taken by your section or anyone else to help minimize this sort of thing?

A We, of course -- if we're aware of the timetable when people in any kind of large construction project, any project, are going to become unemployed, we do take steps to alleviate that hardship by trying to locate jobs elsewhere or relocate the workers and families insofar as is possible to that type of work they're used to.

Q Well, as a result of the missile, so-called problem that you referred to as far as construction is concerned, do you think we've learned anything by that that will help solve future problems that are similar?

A We certainly learned a lot. We, in the 6 months following the missile shutdown, by virtue of a Department of Defense and Department of Labor grant were able to relocate over a thousand workers who were unemployed in the Conrad, Great Falls area, finding them jobs in every other state in the union, including Hawaii by a process of contacting our sister agencies in these states and locating them jobs.

Q Well, you say you learned from that; I guess we can hope if such a similar problem does exist in the event units 3 and 4 are built, that it can be taken care of, based on past experience?

A I can, but I'd like to add this. The people responsible for those hundreds of unemployed in the Great Falls, Conrad area, were the same people that financed the relocation of these unemployed workers to new jobs.

Q Well, the same could happen insofar as other projects are concerned?

A No reason it could not.

Q At line 24 of page 4 you state, "The proposed project will not solve the economic situation presently facing the state and the nation." And this, of course, goes back to what we discussed before; a project of this size is a relatively small one in the overall context of unemployment in the nation as a whole, and so it will in a small way help to a certain extent, solve the unemployment problem anyway; won't it?

A Yes, and I think I acknowledged that in my statement.

Q I noticed you do; no question. You agree with my statement, don't you?

A Yes.

Q As far as your figures on page 5 are concerned, there's no need to go into detail on those, I don't think, Fred; but you say that man-years needed would be three years. Now, where did you obtain that?

A The -- on lines 12 and 13, you mean?

Q Yes.

A Three point seventy five man-years per megawatt needed to built a 500-megawatt plant; I got this figure from my staff and statisticians and economists who tell me that is the normal formula used to estimate numbers of man-years for this particular type of construction.

Q I'm sorry, I didn't refer you quickly enough to the correct lines. Line 15, you say, would be completed in 3 years; where did you obtain that figure?

A I, again, I couldn't personally tell you the time frame there, but the people assigned to work out the details were using some type of information from the best available source. I couldn't be more specific than that. I'm sorry.

Q According to evidence already in in this case, indications are that if unit 3 was commenced this year, that it would not be completed until 1980, which indicates a four-year --

A That would be four years, correct.

Q And I think, perhaps, as far as the contractors and people involved in this job, that figure between four and five years is the one they believe to be the true figure; and I assume that you would not quibble over that?

A I wouldn't, and, of course, that would affect, at the same time, the charts and estimates we prepared using a peak work load of a certain number of people, based upon a shorter time span. And if we added another year to it or another two years, of course, that peak load would likely be less and the construction time longer.

Q I assume you have an unemployment rate as far as Montana is concerned, at the present time; do you not?

A Yes.

Q Is that scale around 10.1 percent?

A Yes. Our new figure will come out today and I'm told it will be slightly less, but the 10 percent figure will be pretty close to it.

Q How many are we talking about; are we still talking around 35,000 or in that figure?

A Probably not quite that many, 32 or 33,000.

Q Thirty-two or 33,000; that's present unemployment in the state of Montana?

MR. BELLINGHAM: No further questions.

HEARINGS EXAMINER: Redirect, Mr. Shenker?

Redirect, by Department of Natural Resources and Conservation

By Mr. Shenker:

MR. SHENKER: Thank you, Mr. Davis.

Q I only have a few questions, Mr. Barrett, that I wanted to ask you about. Mr. Bellingham was asking you if it were not the case, which obviously it is from your answers to the questions, that folks who are on unemployment rolls, if used as construction workers at Colstrip, would then be employed and then they would be off the unemployment rolls and on the employment rolls. I take it that your concern, Mr. Barrett, as expressed in your statement, is that once they've completed their construction tasks, they are back on the unemployment rolls in rather large numbers, based upon your experience in other construction projects?

A Yes.

Q Well, you had adverted to the fact that when the largest single problem manifested itself with the ABM site, that the folks who created the problem were the folks who gave the grant to solve the problem, and that's the United States Government through the Department of Defense and the Department of Labor; is that right?

A That's correct.

Q Has anyone from the Colstrip project management contacted your office to say that the department of Colstrip project management would like to help solve the problems that would come after construction of Colstrip?

A Not up to this point.

Q Mr. Bellingham was also asking you about the reduction of unemployment coming in small pieces here and there. From the vantage point of your office, Mr. Barrett, would it not be preferable to have larger chunks of employment provided so long as that is possible?

A Yes.

Q So if you were looking only at employment prospects in Montana and you had the alternative for employing an additional 350 people as opposed to 95 people; you would certainly want the former alternative, wouldn't you?

A I would think so, yes.

Q The other area that I wanted to ask you about, Mr. Barrett, has to do with this question of economic disruption, which you and Mr. Bellingham discussed briefly. You mentioned to him that when information is given to you, you can then take the steps necessary to do what your office has the competence to do in terms of replacement or reemployment. Have you yet received from the representatives of the Colstrip project management, their schedule, so that you could take whatever steps are necessary to meet or defray the construction impact?

A No, we have not.

Q Have you tried to initiate, Mr. Barrett, any kinds of training programs in the Colstrip area?

A We have contacted the Bechtel Company and have had contacts with the Bechtel Corporation in the past and ongoing, and with other larger employers in the area, employers in the production of the coal; but we have no requests or no specific information on any specific needs at a certain time for certain types of skilled labor from either of those entities.

Q Have you received any cooperation from those folks with whom you have tried to initiate training programs in the Colstrip area?

A Well, we, about three years ago, I attended a meeting at which Montana Power representatives were present, and as I recall Bechtel personnel was present there; and I made the overture, trying to determine from them whatever information they would be willing to give us at a certain time so that we could, indeed, plan and forecast work training programs leading to available and trained labor at a time they would need it. And I got a negative response.

MR. SHERIDAN: I have no further questions. Thank you, Mr. Barrett.

Re-cross, by Applicants
by Mr. Bellingham:

Q What do you mean, negative response?

A Well, I was told that that was information that was not to be given out; that it was company information, that it was in a highly competitive field and they were not -- they just didn't want to cooperate in that manner. And perhaps justly so, I don't know what their own restrictions are.

Q Are you aware of a welding program that was initiated down there in the Colstrip project that was open to anyone?

A Oh, yes. And I say we have had some success in some areas down there, and it hasn't all been negative; but the general approach that we wanted to try to determine, insofar as possible, what training opportunities there would be for employment of Montana people, was pretty unsuccessful as far as we're concerned.

Q Well, now, as far as this welding program is concerned, did you do anything to help provide interested people to go and attend that school?

A If it's a welding program connected with any form of government subsidized training under the Comprehensive Employment and Training Act or formerly the MDTA Act, like that, yes, we do the -- in fact, we do the recruiting for the classes.

Q Well, the particular program that I'm discussing is one that was set up down in the area some years ago; and my specific question is, did you help provide anybody to attend that school?

A Yes, as I was saying, I don't recall circumstances or when it started, but I'll guarantee you that if it's one of the programs that I allude to, we provided everyone -- recruited everyone to attend it.

Q I think in this case there is no evidence you recruited anybody for that school.

A Maybe. It isn't the same type that I'm talking about then.

Q Alright. Now you talk about having not received their schedules, what schedules are you talking about?

A I'm saying a tentative plan that they would be willing to go on that a certain time after the decision is made to start construction, that the employer would be willing to employ a certain number of people who had been trained in the training, coincident with the timing so that they could be employed at the end of their training right into the construction phase.

MR. BELLINGHAM: No further questions.

MR. SHENKER: I have no additional questions. Thank you.

HEARINGS EXAMINER: Very well. You're excused, and thank you, Mr. Barrett, for your attendance.

(WITNESS EXCUSED.)

LEROY PINE, SR., appearing as a public witness, having been first duly sworn upon his oath, was examined and testified as follows:

HEARINGS EXAMINER: I understand, Mr. Pine, you wish to make an oral statement. Please be seated, sir. Speak right into the microphone. You may continue, Mr. Pine.

STATEMENT OF LEROY PINE, SR.

I'm here representing the Rosebud Society of the Northern Cheyenne Reservation, approximately 1,000 in membership, a group that was recently formed on our Reservation, an association; a group that's interested in self-determination and self-sufficiency; aggressive group of local people that are willing to take advantage of the benefits of future coal development. And that is the major plan, is to develop economic benefits through means of coal development; and at the same time to protect our culture in terms of trying to balance the development and at the same time, try to, in the respect, the preservation of our Reservation and culture of our heritage, et cetera.

And we are here on our own free will to testify on behalf of units 3 and 4; and my reasons, and the rest of the members of the Rosebud Society have their reasons, as you will hear them later on. Being the president of this society, my major introductions here is to tell you that we're here because of reasons that we'll present this afternoon. And, personally, my reason for being here is that I know the conditions on the Reservation and I honestly believe that I'm one of the first public officials to ever admit that we can no longer go back and hang on to some of the traditions that we have, which hinder our young people to advance. I honestly believe now is the time to take advantage of the progress and the benefits that we can take through progress; and the sources that we have, which is a great opportunity for the members. And I have recently challenged my colleagues that I was the first one to admit that we need this type of development to help our people. And I have challenged them to a referendum vote on the Reservation and because of being a minority, but a majority of the Grass Roots people, as I believe and am willing to take that challenge, that we're ready for this type of development. And, in connection with this, we need more electricity on the Reservation and increase in population and future development -- coal development on or near the Reservation. And in a sense of a general statement which I think the rest of the members will explain further, that we're trying to change the image of our people. We want them to be trained. It's been too long the United States government has held us back. We want our chance to say, we want to be given a chance to do our own thinking, through self-determination. And we want our people to be trained in skilled jobs. We're tired of two or three dollars an hour wages. We want to get out there just like everybody else, and this is why I'm here today to express my views about just what I've said.

And I could go on further, but as I stated, the rest of the members of the Rosebud Society will express and state their views in similar similarity by statements to testify for the need that we have on behalf of units 3 and 4 at Colstrip. And this is my statement this afternoon.

HEARINGS EXAMINER: Thank you, Mr. Pine. And under our rules now, Mr. Shenker may ask questions on what we call cross-examination.

EXAMINATION OF LEROY PINE, SR.

Cross, by Department of Natural Resources and Conservation

By Mr. Shenker:

Q How did you get up here today, Mr. Pine?

A I drove down.

Q You drove over from the Cheyenne Reservation?

A Yes.

Q With the other folks who are here today?

A Yes, we have two cars.

Q You came down together?

A Yes, we all came down.

Q You are, as I understand it, the president of the Rosebud Society; is that correct?

A Yes, sir.

Q When was the society formed?

A Officially, it was formed in October -- approximately October of '75.

Q Just last October?

A Yes.

Q And the reason for the formation of the Rosebud Society, according to your charter, as I understand it, is for the development and mining of coal on the Reservation; is that right?

A Yes, the major part of the purpose of this organization, and other purposes, too.

Q Since last October, what have you done about the mining of coal on your Reservation; what steps have you taken?

A Well, nothing has been done. As you might have heard or know, the mineral rights are still pending in the Supreme Court -- the mineral rights legislation; the writ of cessionary is now pending in the Supreme Court. And because of this, we are hindered to push for economical development.

Q Haven't you initiated some contact with folks who are interested in developing coal on your Reservation?

A Yes.

Q Could you name those for us, please?

A Well, I can, for the record, I have those people here who could say that I've contacted them and they know the people. Like I said, we have a lot of people; I don't have the list here, and we kind of protect the list because of the reprisals and harrassment that the members are already getting from the opposing party. So the names that I give you today are sitting back there: Wilson Brady and his family; Alfred Strange Owl and his family and relatives, friends; Tom Charley and family, relatives, friends; and Mr. and Mrs. Larry Martin, and I believe, their children. Those are the people that I've named today, whom I have contacted.

Q Mrs. Martin, of course, is the secretary of the Rosebud Society; I suppose she has the records there?

A Yes, she has all the records.

Q Well, I'm concerned, Mr. Pine, about this reprisal that you referred to. Do you mean that there are some folks down on the Reservation who are unhappy with what you are doing, or is it other competing companies that are doing it?

A Because they have taken a stand -- the official body has taken a stand that the whole Reservation is against coal development, and is against units 3 and 4; which is not so.

Q There is always a minority view, isn't there?

A I believe this is a majority view, as I said, I'm the first public official to ever really speak for the Grass Roots people.

Q Let's put it in its proper perspective, then, Mr. Pine. It's true, is it not, that the Tribal Council of the Northern Cheyenne Reservation has disavowed your group?

A Could you explain that please?

Q Yes, that's a big word. It's true, is it not, that the Tribal Council of the Northern Cheyenne Reservation has said that they don't accept responsibility for what you folks say; isn't that right?

A Well, they have reasons, yes; and we have our reasons.

Q Have you or other members of your society, run for office against current members of the tribal council?

A I was trying to think, you mean officers or all the members? The officers?

Q Officers or board members that are council members.

A Maybe one or two, I can think of one who might have run for public office.

Q Have you?

A I am now a public official.

Q Of the Rosebud Society?

A Yes, and the tribal council.

Q You are a member of the tribal council?

A Right.

Q And on the tribal council, I take it, you cast your vote like everybody else?

A Right.

Q And it's true, is it not, that on the tribal council, you have not been able to prevail in the point of view which you want to express?

A I have not prevailed, which, I will prevail.

Q You want to prevail?

A I will prevail.

Q Of course.

A This is a challenge that I took.

Q I understand. Now, as I understand it, the Rosebud Society is in favor of what you call a "balanced coal development"; is that right?

A Could you explain that?

Q Well, I thought you used the term.

A Balanced, yes, limited, in other words.

Q What do you mean by limited; how limited?

A We have mostly terms that they used on the Reservation, general terms of coal development on the Reservation. Number 1, we have full development, just through negotiations with some coal company, and kind of let them have their way, you know, without too many restrictions; and just kind of open up the whole Reservation.

Q You are not in favor of that?

A We are not in favor of that.

Q Okay, so it's something less than that?

A Number 2 is limited development with a measure of control, major control of the people that are allottees or owners, property owners, landowners, mineral rights owners, if any, which that hasn't been determined yet. In other words, major control by the people of the Reservation to sit down and develop, you know, restrictions and protections and et cetera, et cetera. That's number 2.

Q That's the one you're in favor of?

A Yes.

Q Number 3, I take it, would be no development at all?

A Number 3 is totally against.

Q Now, do you understand that here in this proceeding, Mr. Pine, the folks who have to make the decisions, they're called the members of the Board of Natural Resources and Conservation?

A Yes.

Q They are looking at number 2 also; do you understand that, that that's their function to see what limitation should be placed upon the development of coal-fired power plants under the laws in Montana; did you understand that that was the purpose here?

A No, I didn't know that. I don't know all the details. All we know, that they're trying to build units 3 and 4 and I read about headlines and et cetera, and in other words, we are just here to express our need. You know, we don't particularly care who builds the plants.

Q I just wanted to make sure that you weren't operating under the wrong assumptions of what we're doing here in this proceeding. I was afraid that you might think it was a debate between number 1 and number 3; a debate between unrestrained development and no development at all; do you understand?

That's not what we're doing here.

A Well, like I said, all I'm here for is to express the needs and taking a position.

Q Good. Now, you told us that the Rosebud Society is in favor of taking advantage of progress?

A Right.

Q And, I take it that the main function of progress, as it is seen by the Rosebud Society, is economic progress; is that right?

A Economic development.

Q And the main form of economic development that you see is providing jobs; is that right?

A Providing jobs and a future in training --

Q Permanent jobs?

A Permanent jobs.

Q Now, as far as you're concerned, from the standpoint of the Rosebud Society, it doesn't matter to you, does it, whether those jobs will be permanent in Lame Deer or in Forsyth or in Billings or in Colstrip, or someplace else in Montana; does it?

A I'm pretty sure there will be some permanent jobs and some will not be.

Q Well, I'm trying to find out; does the Rosebud Society want to have the permanent jobs on the Cheyenne Reservation or would they be willing to have permanent jobs for members of the Cheyenne Tribe off the Reservation?

A Oh, yes. I don't see how anybody can predict that.

Q Well, what do you want? What would be your preference?

A We want to take advantage of the jobs that are offered.

Q Wherever they are?

A Wherever they are, on or near.

Q On or near?

A On or near the Reservation.

Q Okay.

A We don't have enough jobs on the Reservation.

Q I understand you're saying that, sir. You also said that the Reservation needs more electricity?

A Yes.

Q How much more?

A We have an increase of population, I'd say in about 3 or 4 years, we'll have a population explosion. We'll run out of room to build houses on, where there's water available. And we're going to be needing more electricity to -- well, we're thinking about the development. You got to have electricity, which, the Rosebud Society's goal is that we are going to have more development, regardless.

Q My question is how much more electricity do you need on the Reservation, as you see it?

A I can't predict right now how much we're going to need.

Q Aside from your membership on the tribal council, Mr. Rice, do you have full-time employment?

A I'm an advocate, court advocate, practicing law on the Reservation.

Q And you're paid by the tribal council for that?

A I'm paid for my services. I'm also a police commissioner and also defense court-appointed attorney.

Q Have you had any discussions, Mr. Rice, with the representatives of the construction force --

A Mr. Rice?

HEARINGS EXAMINER: Mr. Pine, I think.

Q Mr. Pine, I'm sorry; I said Mr. Rice, and I'm sorry. Mr. Pine, have you had any discussions with representatives of the construction force at Colstrip; you know, guys from Bechtel or Montana Power, Western Energy Company?

A Discussions?

Q Yes.

A The only discussions -- the only time that I ever had any discussion with the so-called representatives -- I don't know if -- Bechtel, the foreman there -- it was jobs. I was a placement officer, a counsellor for the Indian action program; and all I did was to hand him the names and he talked to me about, "is this a good man" or "what do you think about this man"; you know, nothing political. Nothing political about -- and this was only about two times and I contacted, I think it's Montana Power if they had any jobs available. And I left some names there and I don't think they hired -- they might have hired one or two; and, you know, it's been a long time, about last year.

Q Before you came up here to testify, Mr. Pine, did you talk to anybody from the Power Company or the Western Energy Company or the construction crew down there?

A No, I didn't.

Q You did not?

A No, except the gentlemen that was taking our testimonies here, and I don't know whether he was one of the hearings officers or lawyers; I don't know.

Q The fellow up there with the blue coat?

A No.

HEARINGS EXAMINER: Mr. Ross.

Q Mr. Ross, okay. Have you heard, Mr. Pine, of the offers that have been made to members of the Northern Cheyenne Tribe, that they would receive expense money and $50.00 a day for their time if they were to come here to testify?

A I made that offer.

Q You yourself made that offer?

A Yes, I made that offer.

Q From whom are you going to get the money to pay?

A Well, we have donations -- anonymous donations that we get from several people that, you know, sympathize with us; that we don't, you know, what we're trying to do. They say, you're trying to help yourselves, we'll help you. That's where the money comes from.

Q Now you say these are anonymous donations that are given to the tribe?

A Yes, not -- I can assure you that it's not from Montana Power Company.

Q Well if it's anonymous, you better keep it anonymous.

A Or Bechtel or Peabody or --

Q Just from people?

A Just from some of our friends, yes.

Q And those would be friends who are not members of the Northern Cheyenne Tribe as well as those who might be?

A Yes, it could be friends, I suppose -- it would have to be friends because they help us, anonymously.

Q And those are friends who are both members and non-members of the Northern Cheyenne Tribe?

A Yes.

Q Sure.

A Yes.

Q Now, Mr. Pine, how did you make this offer of $50.00 per day plus expense money to anybody who would come testify; did you do it by word of mouth or by written statement?

A Just by word of mouth.

Q Have you had any takers yet?

A No, I don't think I even have enough to give them right now.

Q Has the Rosebud Society offered to negotiate on behalf of the tribal members for their coal lease rights in return for a part of the negotiated price going to the Rosebud Society?

A To who?

Q Let me try it again for you, Mr. Pine.

A Okay.

Q Have you offered to members of the Northern Cheyenne Tribe, you, on behalf of the Rosebud Society, to negotiate --

A For their mineral rights?

Q For their mineral rights in return for a portion of the payment of the mineral rights going to the Rosebud Society?

A No, we have not. We have not asked them for any percentage of, you know. However, we explained that if there is any services that would be rendered by the Rosebud Society in hiring expertise, that we would deduct in accordance with the law, what we had coming. In other words, we have not made any agreements with the people on the Reservation that they will give us so much. That is a long ways off.

Q That's a long ways off, you say?

A That's a long ways off, yet. I don't mean 5 to 10 years, but, you know, to my estimation, it will be a few years.

Q You would have to wait before the mineral rights have been determined and negotiations have been successful, before you could get a percentage?

A Yes.

MR. SHENKER: Nothing further. Thank you, Mr. Pine.

WITNESS: Thank you very much.

HEARINGS EXAMINER: Mr. Pine, I have a couple of questions. I don't think the record shows that you are a Northern Cheyenne?

WITNESS: I am an enrolled member of the Northern Cheyenne Tribe.

HEARINGS EXAMINER: And the Rosebud Society is made up only of the members of the Northern Cheyenne Tribe; is that correct?

WITNESS: That's correct.

HEARINGS EXAMINER: Alright. Thank you, sir.

(WITNESS EXCUSED.)

MRS. CAROLYN MARTIN, appearing as a public witness, having been first duly sworn upon her oath, both as to her written testimony and as to the oral testimony to follow, was examined and testified as follows:

(THE WRITTEN DIRECT TESTIMONY OF MRS. CAROLYN MARTIN WAS DIRECTED TO BE INSERTED AT THIS POINT.)

STATEMENT OF CAROLYN MARTIN

My name is Carolyn Martin, and I am a member of the Northern Cheyenne tribe. I am also secretary of the Rosebud Society, a legally chartered organization made up completely of members of the Northern Cheyenne tribe, which is in favor of completion of Colstrip Units 3 and 4. It will create job opportunities for the local people and could possibly help the future development of the huge deposits of coal contained under the Northern Cheyenne reservation.

These deposits of coal, if developed properly, could and will change the entire future of the Cheyenne people. It will change their way of life from a poverty stricken, welfare dependent, government controlled race of sorrows to a new class of people; self-governing, self sufficient, self financed and proud race of people. A class of people who will and should take their own place in the society of Montana and the United States.

We are living in a world of high energy supply and demand. We need and use energy in great quantities every day of our lives; in our homes and cars and schools, and we feel that we need it to compete with the rest of the world so that our families will have the same chance in life as the other people of Montana and the world.

For fifty years we have been controlled and dictated to by the Bureau of Indian Affairs, with no control over our property, land or lives. If this is to continue we will be no better off in life than the beggars on the streets of our big city slum areas. This we do not and will not accept.

There is no industry in our area except some ranching and farming which will not support over 3000 people. Colstrip 3 and 4 will supply many jobs for the Cheyenne people and job training for the unskilled members so they can take a useful place in our society today.

HEARINGS EXAMINER: Mrs. Martin, as I've explained to you, you do not need to reread your statement. Is that alright with you? All right. We'll file your statement; it will go to the Board. However, if you have anything to add to it, you certainly will be permitted to it. If you don't, Mr. Shenker will ask you some questions on cross-examination.

Cross, by Department of Natural Resources and Conservation

By Mr. Shenker:

Q Mrs. Martin, I wasn't quite certain from Mr. Pine's answers, whether the information that you may have on the folks with whom there may have been some contact made for negotiations on coal leases, would be confidential information or not; do you know?

A Would you rephrase that, please?

Q Sure. Let me back up a little bit. You're the secretary of the Rosebud Society; right?

A Yes.

Q Do you have some records of names of people with whom the Rosebud Society has negotiated for coal lease development?

A No.

Q You don't?

A No.

Q Do you know of any people or companies with whom the Rosebud Society has negotiated for coal development?

A No.

Q Okay. Then I don't have to ask you if it's confidential, if you don't know. I just want to ask you about your statement, Mrs. Martin. In the second paragraph of your statement -- you have a copy there, don't you?

A Yes.

Q Did you type this statement yourself?

A No.

Q Who typed it for you?

A Somebody here.

Q Somebody what?

A Somebody here.

Q Somebody here, okay. When did you see it?

A Just a little while ago. I wrote it at home.

Q Sure. Your statement says that proper development of coal -- I assume you mean on the Cheyenne Reservation?

A Yes.

Q Would change the way of life of the Cheyenne people?

A Yes.

Q Do you understand that the tribal council now is not interested in the development of the Cheyenne people?

A Yes, that's the tribal council.

Q Unlike Mr. Pine, you're not on the tribal council, are you?

A No.

Q Did you ever run for office there?

A No.

Q Did you hear Mr. Pine's testimony okay from where you were sitting?

A Pretty well.

Q Is there anything you disagreed with in response to what he said to my questions?

A I think it's alright.

Q If it's alright you with, it's alright with me.

MR. SHENKER: Thanks, Mrs. Martin. I have nothing further.

HEARINGS EXAMINER: Do you have anything else you want to add, Mrs. Martin?

WITNESS: No.

HEARINGS EXAMINER: Very well. Thank you for coming. Your statement will go to the Board for their consideration.

(WITNESS EXCUSED.)

VIVIAN SCHINDLER, appearing as a public witness, having been first duly sworn upon her oath, both as to her written testimony and as to the oral testimony to follow, was examined and testified as follows:

(THE WRITTEN DIRECT TESTIMONY OF VIVIAN SCHINDLER WAS DIRECTED TO BE INSERTED AT THIS POINT.)

A statement of Vivian Schindler

My name is Vivian Schindler
I am a member of Northern
Cheyenne tribe and also sit on
the Board of Directors for the
Research Society which is a
legal chartered organization of
Mont. set up for the Northern
Cheyenne tribal members
for the development and mining
of coal on our Reservation. I
I would like to see the
completion of Units 3 and 4
mainly because of economical
standpoint, the [illegible] jobs that
our members can be trained
for and economically [illegible].
[illegible] education. [illegible] stands
[illegible] of the [illegible] jobs available
[illegible] employment [illegible]
on the tribal council [illegible]
[illegible] for the [illegible] building
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]

[illegible]

into the Northern Cheyenne tribe has virtually no chance of obtaining work on the reservation. This is due to Indian preference for all jobs. Units 3 and 4 will provide the training and jobs for non-members and members alike

Vivian Schueller

HEARINGS EXAMINER: You have a written statement, and is it agreeable with you if we file it with the Board, or do you wish to read it into the record?

WITNESS: Pardon?

HEARINGS EXAMINER: We can just file your statement; you don't have to reread it, if that's agreeable.

WITNESS: Just file it.

HEARINGS EXAMINER: And if you have anything you wish to add, you may. If not, Mr. Shenker will ask you some questions on cross-examination.

Cross, by Department of Natural Resources and Conservation

By Mr. Shenker:

Q Miss Schindler, I just wanted to ask you about the statement that appears as the last sentence. You say that units 3 and 4 would provide the training and jobs for non-members and members alike. That, of course, refers to the Northern Cheyenne Tribe?

A Right.

Q Who told you that?

A Nobody, really; I just kind of assumed that, I guess.

Q How many Northern Cheyenne have been employed at Colstrip units 1 and 2?

A I don't know how many have been employed there. I have two brothers that work there. I don't think there's really that many, but that's because there's no cars; they don't have the cars or something to travel back and forth to work on.

Q There are about 3,000 people that live on the Northern Cheyenne

Reservation now?

A Thirty-four hundred.

Q Thirty-four hundred?

A Yes. Around there.

Q You are a member of the Rosebud Society, are you?

A Yes.

Q And about a thousand folks are members of the Rosebud Society?

A Yes.

Q How many members of the Northern Cheyenne Tribe, do you think, could get jobs on Colstrip 3 and 4?

A I would hope to see at least 500, if they had the proper training and stuff. The more the better.

Q And when those units would be all built, Miss Schindler, how many members of the Northern Cheyenne Tribe do you think could have a permanent job at the Colstrip area?

A I really don't know; I really couldn't say.

Q How many would you like to see there?

A I'd like to see them all work there, that don't have jobs.

MR. SHENKER: Okay. Nothing further. Thanks, Miss Schindler.

HEARINGS EXAMINER: Do you have anything else, Miss Schindler?

WITNESS: No.

HEARINGS EXAMINER: Thank you for coming. Your testimony will go to the Board.

(WITNESS EXCUSED.)

LARRY MARTIN, appearing as a public witness, having been first duly sworn upon his oath, was examined and testified as follows:

HEARINGS EXAMINER: Your name is Larry Martin?

WITNESS: Yes.

HEARINGS EXAMINER: And where do you reside, Mr. Martin?

WITNESS: At Busby, Montana.

HEARINGS EXAMINER: And you don't have a written statement; you wish to make your statement orally, is that correct?

WITNESS: That's true.

HEARINGS EXAMINER: Very well. Go ahead.

STATEMENT OF LARRY MARTIN

Well, I'm here as a private citizen, and also, my family is all Indian. I'm a non-Indian. We live on the Reservation. We have a small ranching farm in operation, which has to be helped out with jobs at certain times of the year. And I feel that we need the development of Colstrip units 3 and 4 to provide the job training and the jobs for the people there; not only for the Indians, but the non-Indians who live on the Reservation or close to it. There is no industry there. We need the electricity for power to develop the future coal, in which my family will have a share of a portion of it. It's one of the greatest vast deposits of coal in the United States, we're told; and really, the people there have nothing else for a future.

What little industry there is there is mostly farming and ranching, which they don't employ that many people. And, as a rancher myself, I know that the wages are very low and very limited, and I think that the people there -- there's a great amount of them that don't work, that can't work; they don't have the facilities to get the good jobs, which the development of our coal will help in a vast way. And I think that the development of Colstrip units 3 and 4 will help the Cheyennes' sell their coal or develop themselves in one way or another so that they realize something out of it.

The people there have very little to look back on and very little to look for to the future, unless we get that coal development. And I feel that at Colstrip, there's, in respect to the workers that are from the Northern Cheyenne Reservation and from around there, the non-Indians married to Indians; there's probably in the neighborhood of forty or fifty in the last two projects working at Colstrip. And we feel that maybe it's not a permanent position, but a temporary job is better than no job at all. That's about it, as far as my statement in concerned.

HEARINGS EXAMINER: Very well. You may cross-examine, Mr. Shenker.

Cross, by Department of Natural Resources and Conservation

By Mr. Shenker:

Q And a permanent job is better than a temporary job, of course?

A True, very true.

Q And being trained for a permanent job is better than not being trained for a permanent job, isn't it?

A True.

Q How do you think the development of the Colstrip units 3 and 4 and the two 500-kilovolt transmission lines across Montana will help the Northern Cheyenne Reservation develop its coal?

A Well, they need electricity and power to develop this coal, for one thing. And a few years ago this coal was worth nothing; now, all of a sudden, it's worth something and in the future it could be worth nothing again if it's not used. A lot of our coal is burning underground; it's wasting away, and if it's mined now -- and I feel that even it could be a future sales for our coal in the power plants there at Colstrip. I don't know that for a fact, but we think this could be a possibility.

Q Assume that the power plants have already lined up there source of supply for coal, where do you think you might sell coal from the Cheyenne Reservation?

A Well, I'm sure there's a number of other power companies in the United States that are interested in our coal.

Q How would you get it there?

A Well, that's something we'd have to look to in the future. We don't really know, but there's got to be a way.

MR. SHENKER: Okay, Mr. Martin. I have nothing else. Thank you very much, sir.

HEARINGS EXAMINER: Thank you, sir.

(WITNESS EXCUSED.)

TOM CHARLEY, appearing as a public witness, having been first duly sworn upon his oath, both as to his written testimony and as to the oral testimony to follow, was examined and testified as

STATEMENT FROM TOM CHARLEY:

Resident of the North Cheyenne Reservation

I am not a Cheyenne member, but a representative of the non-members. My wife is Cheyenne, so I have seen both sides and am unbiased.

I have been a resident of the Cheyenne reservation for 12 years, along with my wife and family.

My interest is to provide more job opportunities for the reservation people for all of the qualified people.

I am on unemployment, but I don't want to be; I have to support my family. I have been out every day looking for a job, but there aren't any available. There are no jobs on the reservation to utilize my training. I am a welder and millwright. They have very few jobs on the reservation, but they are preferential, meaning they prefer members, rather than non-members, and are low pay.

If they do open Units 3 and 4 there will be a lot of jobs, more development, no preference, and will provide jobs for skilled and training for the unskilled, and provide future need in jobs for training and future security. It will open opportunities for non skilled personnel, and you could train in a job you were interested in than rather work at a job that you are unhappy in so you could support your family.

The reservation needs more electricity to meet the demands of the people because of the increase in the population and development.

Therefore, I am in total favor of Units 3 and 4 based on the above statements.

Thomas Charley

Tom Charley

HEARINGS EXAMINER: You have a written statement that will be entered into the record here. It goes before the Board. Do you have anything you want to add to your written statement, Mr. Charley?

WITNESS: I'll go with the statement.

HEARINGS EXAMINER: Very well. You may cross-examine, Mr. Shenker.

Cross, by Department of Natural Resources and Conservation

By Mr. Shenker:

Q Are you a member of the Rosebud Society, Mr. Charlie?

A No, I'm not. My wife is and I strongly believe in what she believes.

Q You are not a Cheyenne member, yourself, according to your statement?

A No, I'm not. I'm a member of the Yakima Nation.

Q Do you know a fellow by the name of Allen Shergey?

A I've heard of him.

Q Who is he?

A I don't know.

Q Do you know what a coal speculator is?

A No, I don't.

Q Okay. You are currently not employed, I understand, Mr. Charley?

A That's right, there's no jobs so I cannot work.

Q Have you looked for employment down at the Colstrip site?

A Pardon?

Q Did you try to get a job in building Colstrip 1 and 2?

A I was working down there. I worked for a little over a year, then they run out of work. Now I'm presently drawing unemployment, because I cannot get no jobs over there.

Q What were you trained to do there?

A I was a millwright and a welder.

Q Have you looked for a job someplace other than at Colstrip?

A Yes, I have.

Q Where did you look?

A I've looked all over the Reservation, and I've called down to Decker, Wyoming. There is a few jobs down in Wyoming, but it takes money to move.

Q You say in your statement, Mr. Charley, that the Reservation needs more electricity to meet the demands of the people; is that right?

A That's true.

Q Who do you think should decide the question of how much more electricity is needed at the Reservation?

A Who should decide what?

Q Who should decide how much more electricity you need on the Reservation?

A The people.

Q How do you want them to decide that?

A By the demands. The people, they are building houses every day. In fact, they're in progress building 100 houses right now, and we're going to need more electricity. Plus, if we develop, they are going to need electricity.

Q Do you think it's a good idea for the tribal council to make that decision?

A I have been there 12 years and so far I have seen nothing done to progress these people.

Q Well, is it fair to say that you don't agree with the decisions of the tribal council?

A That's what I said.

MR. SHENKER: Okay. Nothing further. Thanks, Mr. Charley.

HEARINGS EXAMINER: Okay, Mr. Charley. And your statement we have copies of, and it will go to the Board members. You may add anything, if you wish.

WITNESS: Yes, I do. Like, I disagree with some things, like there is a lot of people on the Reservation that are trained, that have been trained. We've got our schools on the Reservation. They're trained for jobs and they cannot get no jobs because there is none. A lot of people are really willing to work and willing to learn. And units 3 and 4, I think, will provide more jobs and more training. That's all I have to say.

HEARINGS EXAMINER: Very well. Anything further?

Continued Cross, by Department of Natural Resources and Conservation by Mr. Sheridan:

Q I just have one question, Mr. Charley. How many more jobs do you think Colstrip 3 and 4 would provide for the Northern Cheyenne Reservation residents?

A How many more jobs?

Q Yes.

A Quite a few.

Q How many?

A I have no estimate of how many, but I know it will sure help out the Reservation.

Q Do you know how many folks in addition to you worked on the Colstrip units 1 and 2?

A No, not really. There was quite a few, but we had to bum rides.

Q About 25 of you altogether, wasn't there?

A I couldn't say; I don't know exactly.

Q Now, wasn't there some discussion about Bechtel providing a bus to bring you folks up to the construction site?

A I heard about it.

Q Did that ever happen?

A No.

MR. SHENKER: Nothing further.

HEARINGS EXAMINER: Mr. Charley, you said you were a member of the Yakima Nation?

WITNESS: Yes.

HEARINGS EXAMINER: Okay, thanks. I wasn't sure. Thank you very much.

WITNESS: I do have something else. I think one of the reasons they didn't provide this bus was because there wasn't enough people, because there wasn't enough trying to get over there, which they didn't have the opportunity to get over there.

HEARINGS EXAMINER: Thank you.

(WITNESS EXCUSED.)

WILSON BRADY, appearing as a public witness, having been first duly sworn upon his oath, both as to his written testimony and as to the oral testimony to follow, was examined and testified as follows:

(THE WRITTEN DIRECT TESTIMONY OF WILSON BRADY WAS DIRECTED TO BE INSERTED AT THIS POINT.)

STATEMENT FROM : WILSON BRADY

60 years old, and an enrolled Cheyenne member.

I have lived on the reservation all of my life and I am in favor of the opportunities and goals and ideas of Units 3 and 4 and meeting the future needs job-wise.

I am in favor of the endeavors and trying to help the needs of the younger generation job-wise, and training to be self-sufficient and not a burden on the Tribe, State and Federal Government all of the rest of our lives.

All of the time when anyone sees us Indians, the image that first comes to mind is that he is dependent on the Government, and doesn't want to work, but that is not true, we want a chance to help ourselves.

I get $29.00 a year from leasing 160 acres of my land. I am looking for other means to benefit from the land. The person who leases my land benefits 10 times more than I receive. I need the money to be able to support my wife and family and make ends meet, to pay overdue bills, and be able to buy things I have always wanted, and to be able to live comfortably. I hope they raise the grazing fees next year.

I am concerned about the electricity, and I know the need. I enjoy the uses of electricity such as television, radio, and record player; electricity is really a necessity. I hope the Units 3 and 4 will keep the prices down.

I also hope that the local younger generation, those that are willing to take the training to make a living, will be offered job opportunities.

Therefore, I am totally in favor of Units 3 and 4 based on the above statements.

Wilson Brady

HEARINGS EXAMINER: Mr. Brady, you've filed a written statement that will go to the Board, and you may certainly add to it if you wish; if you don't have anything further to add at this time, Mr. Shenker will ask you a few questions.

WITNESS: I don't have any.

HEARINGS EXAMINER: Okay, sir. Mr. Shenker.

Cross, by Department of Natural Resources and Conservation

By Mr. Shenker:

Q I've just got one question for you, Mr. Brady. In your statement, sir, you say you're concerned about electricity and you know the need?

A Yes.

Q What is the need?

A I'm sorry, sir. You're going to have to talk a little bit louder; I'm hard of hearing.

Q In your statement, do you have a copy there?

A Yes, I have.

Q Okay. In the third paragraph from the bottom, you say you are concerned about electricity and you know the need. See that?

A Yes.

Q My question to you, sir, is, what is that need?

A The need we have up to this time, I might say, we live on that. Myself, I use electricity in my life now, and I use it in my house. Without it, up to this time, we were in a place where we can't live without it; in a place where the people that's using our land that we used to use for wood to provide for our house needs. Now we can't do that. We use it in a way to try to make ourselves a living -- make a living. That's what we need. I will, like I said in this here statement that I made, I'm ready for this plant that going up, 3 and 4, that will provide for us, for our needs in the future of my younger generation. Up to this time there have been no jobs nowhere. Maybe my younger generation will get the needs of what they want; their education and job opportunities. It's the main thing what we want on the Reservation. I, myself, am 60 years old, but I went through the past years, where we have had easy lives, we have not -- we didn't have to depend on the government to support us. We had cattle; we had horses. We provided for ourselves. We didn't have to run to the government. We didn't have to. Now they roped us into different communities, put us in there; and I don't know who done that, but they put us in one place so we can't even provide for ourselves. They want to give us this and that. And now it's going away, now. We don't know why. They put us into a place where we had to depend of them so much; they did try to help us, they didn't know it. At that time, over there, way back in the '20's and '30's, we had to get out for ourselves; we had cattle; we went out and farmed for ourselves. Now, the government done away with that; took our cattle; killed our -- slaughtered our cattle and horses; and in order for them to put us in one place and give us this and that. Therefore, we don't know where we're at. Why, why is it; I always wonder that. Why, why? Maybe they want to take everything away from us. Maybe that's what they want. To my understanding, I try to tell my younger people, I tell them to get out for yourself. No, they depend on what the government is trying to do. We're living in a place where we can't even talk for ourselves; can't do it. Now if this comes to a head, what we're striving for, maybe we can -- our generation, if they get to know something, get that education where we're striving; if they get that education, maybe then we can go, they can make it easier for themselves. The way we are, we can't do nothing. The age that I am, I'm 60 years old now. It hurts me to look at my grandchildren. What are they going to do. Are they going to keep at this here; going to keep giving us just a little bit -- just enough through one month, every month. Sometimes we don't even make it that month. Sometimes we have to scratch here and there to make a living. Now, what we're trying, it's for our younger generation. That's why I'm for it. Maybe my son, like he's trying to do, go on to school, trying to learn something to get ahead for himself. That's the reason why I'm really for this here. That's the reason why I make this statement. I'm not an educated person to read it out more thoroughly to you people. Do you understand what I'm trying to say? I'm uneducated, where I could read it out more thoroughly so you could understand, that I could bring out the problems that we have back home. This last paragraph, the fourth paragraph I had, that's what I'm talking about. And this last one here, that if this comes to a head, I'll be happy to see my younger generation get the opportunity to get a job someplace where they can help themselves, where they won't be dependant upon the government -- the federal government. That's the main goal that I'm rooting for, myself, up to my age now. And I can't work any more.

Q Go ahead and finish, Mr. Brady.

A Yes.

MR. SHENKER: Nothing further.

HEARINGS EXAMINER: Thank you very much, and your statement and your oral statement will go to the members of the Board, Mr. Brady. Thank you so much for coming.

(WITNESS EXCUSED.)

ALFRED STRANGE OWL, appearing as a public witness, having been first duly sworn upon his oath, was examined and testified as follows:

HEARINGS EXAMINER: We don't have a written statement for this gentleman. Just speak right into the microphone and say whatever you want to say, sir. And your residence is Busby?

WITNESS: Yes, sir.

STATEMENT OF ALFRED STRANGE OWL

Well, most of the other people that I came with covered most of this. What we're striving for is for employment -- we're interested in employment for my people. I'm not the only one that's unemployed down there; there's other people that need something like this to come up. That's why I'm interested in employment. Of course, all my life I've been working for a living. I'm a family man; I've got a big family to support, and as of now I'm unemployed. So I'm looking forward to something like this to come up. So I'm glad this Rosebud Society got something going here and hopefully we can succeed on what we're striving for here.

I think this units 3 and 4 will do a lot of good for my people, like when they sell the coal, that we'll get something out of it; individual people like the young kids and right on up to the old people.

HEARINGS EXAMINER: Did you have anything further, Mr. Strange Owl?

WITNESS: No, sir.

HEARINGS EXAMINER: Very well. You may cross-examine.

Cross, by Department of Natural Resources and Conservation

By Mr. Shenker:

Q Did you come up here today with Mr. Pine?

A Yes, sir.

MR. SHENKER: Nothing further. Thank you.

HEARINGS EXAMINER: I have a question. So the record will show, are you a member of the Cheyenne Tribe, sir?

WITNESS: Yes, sir. I'm a Northern Cheyenne.

HEARINGS EXAMINER: And are you a member of the Rosebud Society?

WITNESS: Yes, sir.

HEARINGS EXAMINER: Thank you very much. Are there any more folks from Busby here, or does that take care of -- Very well. Thank you all very much for coming. You can all be excused or you can stay and listen, if you wish. It's a public hearing.

(WITNESS EXCUSED.)

Shall we start our next witness, or shall we take a short break?

MR. PETERSON: How are we doing on the tape?

HEARINGS EXAMINER: She thinks we better change our tape so we'll take a 10 minute recess and then we'll start with Mr. Carlson.

RECESS 3:02 P.M.

Following a brief recess, the hearing reconvened at 3:15 P.M. on February 23, 1976.

CLINTON E. CARLSON, appearing as a public witness, having been first duly sworn upon his oath, both as to his written direct testimony and as to the oral testimony to follow, was examined and testified as follows:

HEARINGS EXAMINER: Please be seated. Do you have any exhibits with this witness, Mr. Shenker? Are there any exhibits?

MR. SHENKER: He's a public witness.

HEARINGS EXAMINER: Oh, that's right. Mr. Peterson, you may cross-examine.

(THE WRITTEN DIRECT TESTIMONY OF MR. CLINTON E. CARLSON WAS DIRECTED TO BE INSERTED AT THIS POINT.)

TESTIMONY OF THE UNITED STATES DEPARTMENT OF AGRICULTURE, FOREST SERVICE, CONCERNING IMPACT OF EXPECTED AIR POLLUTION EMISSIONS FROM COLSTRIP UNITS 3 AND 4 ON LANDS NEARBY ADMINISTERED BY THE CUSTER NATIONAL FOREST

Presented at the Hearings on Colstrip Units 3 and 4

My name is Clinton E. Carlson. I am employed by the United States Department of Agriculture, Forest Service, Northern Region Headquarters, in Missoula, Montana. As a plant pathologist, I direct evaluations of air pollution damage on State, private, and Federally administered lands under authority of the Forest Pest Control Act of 1947. I received a Bachelor of Science Degree with honors in Forest Science in 1964, a Master of Science in Forest Science in 1966, and am currently studying part time for a Doctor of Philosophy Degree in Botany at the University of Montana. I have published, as sole or joint author, several studies documenting air pollution injury and damage to forests in Montana, Idaho, and Washington, and have participated as a technical consultant in air pollution studies in Alaska and California. As a member of the American Phytopathological Society I serve on the Pollution Damage to Plants committee. I am also a member of the Society of American Foresters and the Western International Forest Disease Work Conference.

I have been asked by Mr. Steve Yurich, Regional Forester of the Northern Region, to present the following statement which characterizes the Forest Service position on the Colstrip 3 and 4 controversy.

The Forest Service is seriously concerned about the potential impact of air pollutants emitted from the proposed coal-fired electrical power-generating facilities known as "Colstrip Units 3 and 4" on nearby lands administered by the Custer National Forest. Currently, the Montana Power Company is constructing two 330-megawatt units, Colstrips Units 1 and 2, from which it is estimated 78 tons of sulfur dioxide will be emitted to the atmosphere each day (Tsao and Wicks, 1974). Units 3 and 4, as reported by Tsao and Wicks (1974) in their recently issued environmental impact statement, will create additional sulfur dioxide emissions of about 182 tons per day. Total sulfur dioxide emissions to the atmosphere from all four units would be ~~260~~ 160 tons per day, or ~~95,000~~ 57,000 tons per year, assuming that best practical control technology for sulfur dioxide will be continuously employed at design efficiencies. In addition to the sulfur dioxide emissions, nearly ~~220~~ 184 tons per day of nitrogen oxides, 162 pounds per day of fluoride, and significant amounts of trace metals will be released. Tsao and Wicks (1974) concluded that Units 3 and 4 likely will not meet Federal and State air quality standards.

The Ashland Division of the Custer National Forest at its nearest point is located about 24 miles southeast of Colstrip. This is directly downwind of the generating complex and the pollutants will be carried by wind and will impact the extensive ponderosa pine forest and grasslands ecosystems that prevail on this part of the Custer Forest. It would be difficult to predict precisely the consequences of the intrusion of air pollutants emitted by the Colstrip project on resources within the Custer Forest. However, a few examples may give some insight to the problem. Carlson et al. (1974) documented serious sulfur damage on Douglas-fir near a pulp and paper mill in western Montana. Trees on more than 5,000 acres showed visible injury, and mortality was significant on nearly 1,000 acres. The cause was shown to be a combination of hydrogen sulfide, mercaptans, and sulfur dioxide emitted from the pulp mill. Sulfur dioxide emissions were approximately 10 tons per day during the period when extensive damage occurred. Although SO_2 emissions have been reduced to less than 2 tons per day, continued mortality of reproduction is evident today.

George G. Hedgcock and Theodore C. Scheffer in 1955 published data on injury to northwestern forest trees by sulfur dioxide from smelters. In their report, they discussed environmental effects of sulfur dioxide emitted from a copper smelter at Anaconda, Montana, and from a lead smelter at Trail, British Columbia. Injury to sensitive forest trees was noted up to 22 miles from the Anaconda smelter and 53 miles from the smelter at Trail, British Columbia. Sulfur dioxide emissions from the Anaconda smelter were not given, but averaged about 225 tons per day at Trail. Damage varied from complete tree mortality over large areas near the smelters to slight browning of trees at greater distances. Surviving trees in the damaged zones exhibited significantly reduced diameter growth.

The United States Environmental Protection Agency (1971) published data concerning damage to Christmas tree plantations 20 to 25 miles from a coal-fired electric power-generating facility in West Virginia which was emitting about 325 tons sulfur dioxide per day. The damage represented a significant economic loss to the Christmas tree growers.

These examples, with sulfur dioxide emissions similar to or less than those expected from the complex of Colstrip Units 1-4, strongly indicate that significant deterioration of the sulfur dioxide-sensitive ponderosa pine forest may occur in the Ashland Division of the Custer National Forest. However, we have little data to provide us with insight on grassland effects.

Additional cause for concern is given by Oden (1968), Likens (1972), and Likens et al. (1972). These scientists have shown that sulfur dioxide can be converted to sulfuric acid while in the air and may be brought to the ground a hundred miles or more from the source in the form of acid rain. Acid rain will cause needles to brown and fall prematurely from conifers such as ponderosa pine.

Sulfur dioxide, fluorides, and other gaseous air pollutants toxic to vegetation enter the plant through the leaves and needles. Here they eventually cause the chlorophyll to break down, and the needles become yellow or brown. Chlorophyll is absolutely essential in order for the plant to produce the sugars, starches, and other biochemical compounds that the plant needs not only to survive but also to grow. If the chlorophyll is eventually destroyed completely or partially, the plant either dies or its growth is retarded. Destruction of the chlorophyll can occur very rapidly if the pollutant is present in large amounts; this is called acute injury. Very low concentrations of a pollutant over extended periods of time also will cause injury, and this is termed chronic injury. We expect the chronic type injury to be most prevalent at Colstrip because it is not expected that sulfur dioxide concentrations will be extremely high in the Custer Forest area. Rather, low concentrations will be continuously present and may, over a period of 5 to 10 years or more, lead to injury on the pines. In the EPA study mentioned earlier, sulfur dioxide injury occurred in the areas where the annual average concentration of sulfur dioxide in the air was less than 0.01 parts per million, which is less than one-half the standard set by the State of Montana.

Weakened ponderosa pine are susceptible to attack by bark beetle insects and many reports are available which document this. Of particular interest is the well designed study by Stark et al. (1968) which describes weakening of ponderosa pine by photochemical oxidants in the Los Angeles, California, area. Weakened trees were soon infested and killed by bark beetles. Ponderosa pine in the Colstrip area may suffer the same fate. In fact, a similar sequence recently occurred on the Ashland Division of the Custer Forest and on the Northern Cheyenne Indian Reservation, adjacent to the Ashland Division on the west. Dewey et al. (1974 reported that an epidemic of pine looper, a caterpillar that feeds on pine needles, weakened the pines in the Ashland and Northern Cheyenne forests to the extent that bark beetles invaded and killed the pines, resulting in a loss of over 3 million board feet. Air pollutants could cause a similar weakening of pines, allowing buildup of bark beetles and resulting in very large volume losses.

Based on this evidence, the Forest Service is justifiably concerned that air pollutants, particularly sulfur dioxide and fluorides, emitted from the Colstrip electric generating complex will cause growth reduction, eventual weakening, and possible death of pines on the Ashland Division of the Custer National Forest. In addition, the heavy metals emitted, such as mercury, pose a threat to wildlife in the area through ingestion of contaminated natural forage. The Forest Service currently is initiating baseline studies in the Ashland Division so that future impact caused by air pollutants from the Colstrip electric generation can be accurately assessed.

The Forest Service urges that the Montana Board of Natural Resources, in making a decision on the application for construction of Colstrip Units 3 and 4, give serious consideration to the potential for damage that may be caused to flora and fauna within the ponderosa pine and grassland ecosystems by air pollution from the Colstrip complex.

Respectfully submitted,

CLINTON E. CARLSON
Leader
Air Pollution Group
Forest Environmental Protection
State and Private Forestry
USDA Forest Service, Northern Region

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EXAMINATION OF CLINTON E. CARLSON

Cross, by Applicants

By Mr. Peterson:

Q Your name is Clinton Carlson?

A Yes.

Q And where do you reside, sir?

A I reside in Florence, Montana.

Q And how long have you resided in Montana?

A Most of my life, say 28 years.

Q How long have you worked for the United States Forest Service at the Missoula headquarters?

A For 10 years.

Q And what are your duties there, Mr. Carlson?

A I'm employed as a plant pathologist, and my major duties are the evaluation of the impact of air pollutants on forest ecosystems.

Q And, as I understand it, that has been principally in the state of Montana, has it?

A It involves Montana, northern Idaho, part of Wyoming, and northeastern Washington.

Q What plants have you studied in northeastern Washington?

A We have an intensive base line study relative to a magnesium plant that Alcoa is putting in at Addy, Washington.

Q Magnesium?

A Yes.

Q You are presently undertaking some graduate work at the University of Montana?

A Yes, sir.

Q And that is working toward a doctorate degree?

A Yes.

Q And I assume that in that endeavor you are associated with Dr. Clancy Gordon?

A He's on my committee.

Q And that is to evaluate your thesis?

A That's one of his responsibilities, yes.

Q And I noticed also accompanying you here today was Mr. Tourangiean; is that right?

A Yes, sir.

Q Have you corroborated with Mr. Tourangiean and Dr. Gordon in the preparation of this statement?

A No, sir.

Q With regard to the particular emissions which you recite, Mr. Carlson, those figures, as I understand it, the 78 tons of sulfur dioxide from Units 1 and 2, you quote Tsao and Wicks?

A 1974, yes.

Q And also cite Tsao and Wicks for the emissions on 3 and 4; is that correct?

A Yes.

Q And I assume that's from the draft Environmental Impact Statement of the Department of Natural Resources?

A That's true.

Q Have you had an opportunity to examine the findings of facts issued by the Board of Health since the preparation of this statement?

A Yes, sir; I have a copy with me.

Q And have you revised any of your estimates relative to the emissions?

A Yes, I have revised them on my testimony.

Q Where is that revision?

A It's not on the one that you have, I don't believe.

Q No, I don't think it is.

A This testimony was written at the end of last summer; I did not know when this part of the hearing would really convene.

Q Where are your present figures?

A So my figures are now, if you want to look on page 2, for total sulfur dioxide emissions from all units, would be approximately 160 tons per day, or 59,000 tons per year.

Q Give me those figures again?

A I have 160 tons of sulfur dioxide --

Q Rather than the 260?

A Rather than 260, yes.

Q You have 160?

A Yes.

Q Is that under worst case conditions?

A That's under the 1 percent sulfur coal at best controlled technology.

Q In other words, you computed it at 1 percent sulfur coal?

A Yes.

Q And what were your total emissions, 59,000?

A Fifty-nine thousand tons per year. These are not my computations; these are from the findings of fact sheet.

HEARINGS EXAMINER: Let me ask a question. Do you have a new statement different than the one you sent me, or just those minor changes?

WITNESS: No, Mr. Davis, I've just penciled those changes in on my original statement.

HEARINGS EXAMINER: Oh, fine, thank you.

Q Have you revised your statement where Tsao and Wicks concluded that 3 and 4 likely will not meet the federal and state air quality standards, or is that still your position?

A I'm not sure what Tsao and Wicks finally concluded on their statement.

Q But you cite them for the authority; do you have any other authority that the units likely will meet the federal and state air quality standards?

A Not at this time.

Q And has the --

A Excuse me; I think the finding of fact sheet did conclude that the units would meet the applicable federal and state standards for SO_2 emissions.

Q Now with regard, Mr. Carlson, to that position, wasn't it one of the concerns of the Forest Service that since the emissions from the proposed plants will probably reach the national forest lands that they felt that the plants must meet existing air quality standards as an initial step in minimizing or eliminating impact?

A As an initial step, yes.

Q And that if that is a fact then that the SO_2 and particulate emissions will meet the standards that will minimize or eliminate the impacts on Custer National Forest according to the --

A No, I don't believe that to be the case at all. In the studies that I have personally conducted on the ground in Montana and other places, even though the state standards and the federal air quality standards were met within reason, we were still able to document serious damage to the ecosystems that we were evaluating. So whether or not the company meets the standards right now, it's important that it doesn't mean that damage is not going to occur on the Custer Forest.

MR. PETERSON: What is my next exhibit number?

HEARINGS EXAMINER: Just one moment, please. I think it's 136, but did we have a 135?

MR. PETERSON: One or two?

HEARINGS EXAMINER: Pardon?

MR. PETERSON: One hundred or two hundred?

HEARINGS EXAMINER: One.

MR. SHENKER: No, he's at 200 already, I'm sure.

MR. PETERSON: I thought we were at 235; I thought 235 was the last exhibit I put in.

HEARINGS EXAMINER: All right, Mr. Bellingham put in exhibit I had marked 134 was some figures on the black forest you were going to re-type and get to us?

MR. SHENKER: That should be 234, I think.

HEARINGS EXAMINER: All right. So make this 234 then.

MR. PETERSON: 235?

HEARINGS EXAMINER: 235, yes.

MR. BELLINGHAM: 235 is a letter from the Northern Plains Resource Council on land.

MR. PETERSON: That's right; I should have 236 then.

HEARINGS EXAMINER: 236.

Q Mr. Carlson, I am handing you what has been marked as Applicants Exhibit 236 and I'll ask you if that is not a document written by the Forest Service to the Department of Natural Resources on January 9, 1975?

A Yes, it is.

MR. PETERSON: We'll offer Applicants Exhibit 236.

Q Now, Mr. Carlson, you're acquainted with the fact the United States Environmental Protection Agency is charged by law with the adoption of standards to protect the public health and welfare with an adequate margin of safety; is that correct?

A That's true.

Q And you understand that the United States Environmental Protection Agency has adopted second standards called secondary standards for the protection of public welfare?

A That's true.

Q Which includes vegetation, wildlife, and the like?

A Yes.

Q And your position, I take it, is that those standards are not stringent enough and that the Environmental Protection Agency's secondary standards will not protect the public welfare?

A Exactly.

Q How far is Custer National Forest from Colstrip units 3 and 4?

A The nearest point is about 24 miles, air miles.

Q And what direction is that?

A That's southeast of Colstrip.

Q And do I understand that there are certain base line studies that are now being undertaken by the Forest Service under a grant to gather data on the ecosystems?

A Your understanding is correct.

Q Have you participated in that study?

A Yes, I have.

Q And who else has participated in that study?

A Dr. Clancy Gordon and the environmental studies lab is a cooperater in that study.

Q And have you done any base line data work at or around the Colstrip plants themselves?

A Yes.

Q And was that under a federal grant?

A That's under the study that we are talking about right now.

Q It's the same study?

A That's true.

Q And with the same individuals?

A That's right.

Q With regard to some of the examples that you cite in your statement, for example, you cite a paper and pulp mill in western Montana. What mill is that?

A That's the Hoerner Waldorf pulp and paper mill at Missoula, Montana.

Q Do you know whether or not at the time that the sulfur damage was observed that the mill was running in excess of the applicable standards?

A With the monitoring equipment that was available at the time, the pulp company officials indicated that they were within the applicable federal and state standards.

Q Was that for ground level concentrations or emissions?

A That's for ground level concentrations.

Q Now about the plant at Trail, British Columbia?

A At Trail, B.C.? I don't know whether they were in compliance or not.

Q And how about the copper smelter at Anaconda?

A There is evidence to indicate that they were exceeding state standards at several locations.

Q As a matter of fact, they're running on a variance right now, aren't they?

A That's true.

Q And isn't it also the same for the East Helena plant? They are on a compliance schedule, but they are running in excess of the standards?

A Yes.

Q And the Tacoma plant that you mentioned in here --

A I didn't understand, pardon?

Q Did you mention a plant in here from Tacoma, Washington?

A I don't believe so.

Q Did you do some work at one of those plants?

A In Tacoma?

Q Yes.

A No.

Q You did not. Have you made any studies to predict what the ground level concentrations might be at the Custer National Forest?

A Ground level concentrations of SO_2 or --

Q Yes, of SO_2.

A No, I don't consider myself a meteorologist or a modeler so I have not undertaken those actual studies. Other people are more qualified to estimate the concentrations of pollutants at different positions from the plant.

Q Isn't it true, Mr. Carlson, that it's absolutely essential to know what the concentrations will be on a particular species in order to determine whether there is going to be any injury or damage?

A I don't think that we've reached that state of knowledge yet where we can predict with any degree of accuracy what the levels of pollutant might be at that distance. In fact, we don't really know how they're -- with certainty -- how they're carried in the atmosphere; we don't know what happens to the pollutants in the atmosphere while they're there; we certainly don't know what to expect 24 to 40 miles from the Colstrip plants, except that there is a distinct possibility that the pollutant may come down as a form of acid rain or some other type; and we do know that that can cause damage to vegetation.

Q And that, you say, is a possibility?

A That's right.

Q Which you don't have any data to support one way or the other at this time?

A The only data that I can bring forth at this time would be the examples that I've cited that you brought out, some (?) schedules to meet a standard.

Q Now then --

A Let me finish, please. Data is currently being assembled at the environmental studies lab at the University of Montana that would certainly indicate that concentrations that are known to damage plants will reach the Custer National Forest area.

Q In what concentrations?

A We're talking in terms of an acid rain fallout; the concentration I'm not sure of. I don't think the figures are completely done yet. They will be presented in testimony that is anticipated at a later date.

Q From whom?

A From Mr. Tourangiean and Dr. Gordon.

Q With regard to the Mount Storm of the West Virginia plant, do you know whether or not those generating facilities were running in violation of the applicable standards, federal standards, at the time?

A According to the EPA study that was done, at least the document I have, the average annual concentration of SO_2 was less than .01 parts per million which is less than the federal standard and yet there was a significant amount of damage that was accorded to the Christmas trees and Christmas tree growers.

Q You understand that that particular matter with regard to at least the Allegheny power suit is still in litigation and has not been decided yet by the federal court?

A That may be. I understand also that there have been numerous awards made to the Christmas tree growers at this time which would indicate some sort of admission by the companies that indeed they had polluted and caused damage.

Q That's what you understand to be?

A That's true.

Q Have you talked to anyone with West Virginia Electric Power Company as to why those settlements were made?

A No.

Q And I assume that your information relative to those settlements came from Dr. Gordon?

A It came from the depositions and from Dr. Gordon, yes.

Q Were you a witness in that case?

A No, I wasn't.

Q What is the present programming that is being undertaken at the Custer National Forest by the Forest Service?

A The program is documented in an in depth study plant that we put out last summer, but briefly it involves the establishment of a series of vegetational plots within the Custer Forest ranging from the nearest point at 24 miles to up to 100 miles away in the Black Hills National Forest down in South Dakota. Of course, those would be the extremes. In each one of those plots we've selected a certain number of ponderosa pine trees in which we could anticipate that we can sample continuously for a period of 10 to 20 years or even longer than that. We are measuring such things as average needle retention, total sulfur, total flouride, in terms of chemical analysis; we are measuring the lengths of the needles by different years of origin; we are making total chlorophyll analyses, typical things that one would do in a forest situation to try to evaluate the potential or future effects of something like SO_2 or other pollutants.

Q Are you undertaking any studies at the present time with experimental plots and dosing them with SO_2 in this study?

A Well, relative to this study, just before the study got off the ground, I did conduct a controlled fumigation study in our own laboratory in which we fumigated Ponderosa pine and Douglas fir with sulfur dioxide, hydrogen flouride, mercaptan. We also induced nutrosis or tissue death by simulated winter drying, heat drought, salt damage, and we have investigated those results histologically. In other words, we made autopsies of the different types of damage, and we're confident that we cannot identify SO_2 damage versus something that is caused by winter drying or normal drought in the summer time.

Q Have you made any studies in the field, other than laboratory ones?

A Yes, I have; in other parts of the state you mean?

Q With relative to dosing of the plots with SO_2 and fumigation?

A No, no.

(Pause)

MR. PETERSON: I have nothing else.

HEARINGS EXAMINER: Now in regard to this exhibit, even though we are not going to let redirect on public witnesses, I'm certainly going to let you make objections to any exhibits that are offered by public witnesses as we have in the past. Do you have any objections to this exhibit that has been offered here?

MR. SHENKER: I have a couple of voir dire questions.

HEARINGS EXAMINER: Certainly.

Voir Dire by Department of Natural Resources and Conservation

By Mr. Shenker:

Q Mr. Carlson, on the exhibit that was tendered to you, Exhibit number 236, it's dated January 9, 1975, had you seen it before today, sir?

A I recall seeing the exhibit at the time it was put together, but I really don't recall the contents in detail.

Q Well, let me -- I guess this is the only copy.

(Gives copy to witness.)

Q Did you have some input in preparing the material that appears in that letter?

A Yes, I did; I was a member of an ad hoc committee that put this letter together.

Q All right, sir. Does that letter comport with the views that you have expressed in your statement as a public witness in this proceeding?

MR. PETERSON: We'll object to that on the grounds that the exhibit speaks for itself.

MR. SHENKER: In your view.

MR. PETERSON: Well, the voir dire examination is going now beyond the confines of identification of the base and foundation.

MR. SHENKER: Well, if we've got conflicts, I'd like to know.

HEARINGS EXAMINER: Well, I'll overrule that; you can answer that question if you think the letter is the same as your testimony or not or if there's a difference.

WITNESS: Yes, I think that the letter supports my testimony.

MR. SHENKER: In that event, I have no objection to Exhibit number 236.

HEARINGS EXAMINER: Very well, Applicants Exhibit number 236 is admitted, and you are excused. Your testimony will go to the board and thank you, Mr. Carlson.

(WITNESS EXCUSED)

HEARINGS EXAMINER: Next witness, Mr. Posewitz. Mr. Carlson, before you leave would you stop and take her copy of your testimony and make those changes so we'll be sure and have the right figures?

JAMES A POSEWITZ, called as a witness by the Department of Natural Resources and Conservation, having been first duly sworn upon his oath, both as to his written direct testimony and as to the oral testimony to follow, was examined and testified as follows:

HEARINGS EXAMINER: Please by seated and we'll start with you. (Thank you, Mr. Carlson.) Mr. Shenker, do you have any exhibits with this witness?

MR. SHENKER: Yes, Mr. Davis, the Department of Natural Resources and Conservation will tender the statement of testimony of James A. Posewitz and offer in connection therewith and through that testimony the Exhibits numbered 49 through 54.

(THE WRITTEN DIRECT TESTIMONY OF MR. JAMES A. POSEWITZ WAS DIRECTED TO BE INSERTED AT THIS POINT.)

STATEMENT OF TESTIMONY

OF

JAMES A. POSEWITZ

My name is James A. Posewitz. I am a resident of Helena, Montana. I first came to Bozeman, Montana, in 1953 to attend Montana State University. I received a B.S. degree in Fish and Wildlife Management from Montana State University in 1957. Following a tour of duty with the U. S. Army in Germany, I returned to MSU and received a M.S. degree in Fish and Wildlife Management in 1961.

Following graduation from Montana State University, I began employment with the State of Montana's Department of Fish and Game, and have been so employed since 1961. I have held positions with the Department of Fisheries Biologist, Fishery Manager, Chief of the Water Resources Development Section, Chief of the Environmental Resources Division and I currently am the Administrator of the Environment and Information Division.

In 1974, I was the recipient of one of 10 American Motors Conservation Awards given to honor individuals and non-profit organizations for outstanding efforts in conservation of the Nation's natural resources.

The Montana Department of Fish and Game is charged with and responsible for the protection, preservation and propagation of fish, game, fur-bearing animals and nongame wildlife in the State of Montana. In August, 1973, the Montana Department of Fish and Game contracted with the Montana Department of Natural Resources and Conservation to conduct a study of the Yellowstone River in Montana, including the aquatic ecosystem, game resources and recreational-historical aspects, and to prepare a report designed to be part of the Environmental Impact Statement for the proposed Colstrip Units 3 and 4 of the power generating complex at Colstrip, Montana. Based upon that study and the Department's historical knowledge of the area around Colstrip, it is the conclusion of the Montana Department of Fish and Game that the construction of Colstrip power plants 3 and 4 would place a demand on the land and water resources of this State that would diminish the fish and wildlife resources the Department is responsible for protecting and preserving for future generations of Montanans. The risk of destruction to these valuable natural resources based upon present knowledge, compels the Department of Fish and Game to recommend denial of the application for Colstrip Units 3 and 4.

The Department of Fish and Game has been deeply concerned with the maintenance of adequate water flows on the Yellowstone River. Of particular concern to the Department of Fish and Game is the amount of water to be diverted from the Yellowstone River and consumed in the process of converting coal to electrical energy. In order to preserve the fish and game resource of the Yellowstone River area, the Montana Department of Fish and Game has made application for a reservation of flows as provided for in the 1973 Montana Water Use Act.

The copy of that application is attached to this statement, marked Exhibit "49". This application was prepared under my supervision and control in the ordinary course of business. The application recites many of the reasons for the reservation on the basis of need and rather than elaborate separate from the application itself, I have included the application as part of my statement for reference.

The quantities of water applied for in the application for reservation of flows on Yellowstone River are essential to maintaining the fish and wildlife resources of the Yellowstone River. Any proposed consumption of water from the Yellowstone River inconsistent with that application for a flow reservation would, in our opinion, contribute to the degradation of the fish and wildlife habitat of the entire Yellowstone River. The application is still pending before the Board of Natural Resources and Conservation. The proposed withdrawal of 15,700 gallons per minute to supply Colstrip Units 3 and 4 most certainly would cause degradation of the fish and wildlife habitat.

It is necessary to emphasize that diversions at any point along the Yellowstone River such as that proposed at Nichols, Montana, for Colstrip Units 3 and 4, affect the river not only at that point, but have the potential to affect it upstream and downstream from the diversion point. These individual diversions must be viewed in the context of their contribution to the total consumptive water demand already impacting the river and the quantities of water being sought for consumptive purposes in the future. The factors limiting and which provide for the natural communities of the river are most effective during extreme flows and flow averages are of little value as points of reference. The applicants' witnesses or consultants have attempted to improperly use this data to support their position. In fact, Westinghouse Environmental Systems attempted to credit me for statements contained in their Environmental

Analysis, which after I learned of the content in their publication compelled me to disclaim in writing to the Westinghouse people.

Exhibit "50" is a flow duration hydrograph for the Yellowstone River at Miles City calculated from a 39 year period of record beginning October, 1932. Exhibit "51" is the flow duration hydrograph for the Yellowstone River at Sidney, calculated from a 29 year period of record beginning October, 1942. Exhibit "52" is a flow duration hydrograph for the Yellowstone River at Billings, calculated from a 39 year period of record beginning October, 1932. Each of said Exhibits was produced for the Department of Fish and Game for use in the Department's regular course of business by the United States Geological Survey. The flow duration hydrographs illustrate the water discharge of the Yellowstone River responsible for the maintenance of the fish and wildlife resource of the Yellowstone River and its immediate floodplain as we find it today.

If the State of Montana is to meet the needs of the fish and wildlife resource of the Yellowstone River, it must begin by either denying or modifying each consumptive water use demand to meet the conditions outlined in the Fish and Game Department's application for a flow reservation in the Yellowstone River. Unless these individual demands can be so modified or denied, it is a certainty that their accumulative effect would preclude the maintenance of the fish and wildlife resource of the Yellowstone River and its immediate floodplain.

The cumulative demand for Yellowstone River water has been well documented and it cannot be denied that many now compete for the limited supply. The State of Montana cannot ignore the obvious total demand for Yellowstone River water, and cannot consider the application for Colstrip power plants 3 and 4 in the context that it may be the only new industrial demand being made on the Yellowstone River water resources.

Of particular concern to the Department of Fish and Game is the nature of the new industrial water demands in that withdrawals are proposed for all seasons of the year. Presently, the consumptive use of Yellowstone River water is predominantly that of irrigated agriculture, a demand that occurs during a limited season of the year. The fishery resource living in an aquatic environment reaches its maximum carrying capacity following the open water growning season. Over the winter period these populations are subsequently reduced, indicating that the carrying capacity of a flowing aquatic environment is regulated by environmental conditions during the winter months. The factors causing this reduction are only now being thoroughly investigated, and until they are thoroughly understood, water depletions during this period of the year must be prevented.

Other factors that must be understood before additional water depletions can be authorized include:

(1) Understanding the ecological relevance of spring flood flows as they affect sediment transport, floodplain integrity and the spawning of nonsalmonid fishes;

(2) The pollution loading of the Yellowstone River as it is related to diluting river flows, concentrating total dissolved solids and ultimately, the primary productivity/dissolved oxygen balance of the river;

(3) The life history of nonsalmonid fish inhabiting

the middle and lower Yellowstone River;

(4) The impact of individual water withdrawals on larval fish forms; and

(5) The ecology of aquatic invertebrate and forage fish species, vital links in the aquatic food chain.

Most of these items mentioned are presently under study; however, these studies are relatively new and adequate data are not available to support the contention that Yellowstone River flows can continue to be depleted without adversely affecting the fish and wildlife resource of the river. Accordingly, the applicants' contentions in this respect are without any basis from a scientific standpoint that is acceptable from the standpoint of taking a risk involving the continued viability of these fish and wildlife resources. In that regard, to the best of my knowledge, the Montana Department of Fish and Game has conducted and is continuing the only field investigations on the Yellowstone River into the impact on the fish and wildlife resource that involve the actual collection of fish and wildlife data. To date, none of these investigations has supplied any information that could lead anyone to conclude that further depletions of Yellowstone River flows would not adversely affect the fish and wildlife resource. To that end, the Department and I have continually reminded those who attempt to use our data of the data's severe limitations. For example, Exhibit "53", is a letter written by me to Westinghouse Environmental Systems concerning their attempted use of data which I had previously warned them was severely limited. Also attached is a letter dated May 8, 1973, marked Exhibit "54", written by Keith Seaburg, a staff member of the Department of Fish and Game, warning Westinghouse of limitations of the data upon which Westinghouse was making assumptions. This letter came to me in the regular course of business.

The Montana Department of Fish and Game reaffirms its original recommendation to the Department of Natural Resources that the application to construct Colstrip power plants 3 and 4 be denied until the impacts of plants 1 and 2 can be evaluated, and the plans can be developed for supplying water consistent with the reservation of flow application that is appended to this testimony, and further, until the ecology of the Yellowstone River is understood based on the biology of the fish and wildlife species involved.

MONTANA FISH AND GAME COMMISSION
March 15, 1974

APPLICATION FOR RESERVATION OF FLOWS - Yellowstone River

As authorized in Section 26 of the Montana Water Use Act of 1973 and as guided by the constitution for the state of Montana to preserve a clean and healthful environment as an inalienable right of Montana citizens, the Montana Fish and Game Commission hereby respectfully applies for a reservation of flows in the Yellowstone River. The objective of this reservation is to generally sustain the existing aquatic ecosystem, specifically the fish and wildlife resource of Montana, the recreation that resource supports and the unique quality of the healthful Montana environment the fish and wildlife of this state reflects.

The Purpose of the Reservation

The purposes of this reservation of flows are to insure that adequate flows are present in the Yellowstone River to honor all existing water use rights, to support aquatic life as it is now found in the river, to maintain Canada goose and other waterfowl populations, to provide necessary habitat for all forms of wildlife, to sustain high levels of water quality, to provide water-based recreational opportunities and to generally contribute to a clean, healthful environment.

It is not the purpose of this application to in any way conflict with Senate Bill No. 728 introduced and passed by the 43rd legislative assembly and signed into law by the Governor, which is an act providing for the suspension of action on certain applications for permits to appropriate surface water or for changes in purpose of use in the Yellowstone River basin for three years.

It is the purpose of this application to have before the Board of Natural Resources an application that supports the purpose and philosophy contained in Senate Bill No. 728 in the event that unanticipated or unforeseen points of technicality or legal procedures should in any way circumvent the intent of the legislation.

The Need for the Reservation

The need for a reservation of flows in the Yellowstone River is embodied in the habitat requirements of all fish, wildlife and other living organisms that have through the long evolutionary process come to be totally dependent upon the natural flow of the Yellowstone River. Fish production in rivers depends upon maintenance of spawning and rearing areas, sufficient shelter, adequate food supply and water quality. The stream discharge, as influenced by channel configuration must meet the hydrologic requirements necessary to provide these factors. Over the centuries, fish populations in the Yellowstone River have survived and become attuned to both flood and drought, and today within that same framework they sustain themselves at levels allowed by the natural limiting factors found within the extremes of their environment.

Paddlefish migrate up the Yellowstone River each spring to spawn. Observations in Missouri indicate that paddlefish migrate in response to water temperature, photoperiod and an increase in flow level (Purkett, 1961). The Yellowstone

Exhibit No. "49"

paddlefish run also occurs coincident with spring runoff (Robinson, 1966). Strength of the spawning run is associated with the duration of the seasonal rise, rather than the height of the rise. The increase in flow is necessary to trigger the run, allow passage of the migrant fish to the spawning areas and provide adequate spawning habitat (Vasetskiy, 1971). The spring rise must be maintained in the Yellowstone to meet the reproductive needs of this population of paddlefish and thus is included in the reserved flow of the Yellowstone River.

Spawning habitat requirements of other spring spawners, i.e., walleye, sauger, burbot, shovelnose and pallid sturgeon, and the forage species that support them must be identified and maintained. Walleye and sauger spawning activities occur when water temperatures are between 41 and 53° F (Morris, 1970; Carufel, 1963; Niemuth, et al, 1962). Spawning sites are reported to have a supply of moving water and a clean substrate.

Two populations of sturgeon, the pallid and the shovelnose, currently inhabit the Yellowstone River. Life history information of these species is extremely limited. Held (1969) reported that shovelnose sturgeon generally prefer a flowing water environment and may enter tributary streams at times of spawning. Dam construction on the mainstem Missouri River has effected the reproductive potential of the shovelnose through a reduction in stream velocity. Reductions in existing water levels may affect the existence of these populations of sturgeon in the Yellowstone River.

Channel catfish spawn when water temperatures exceed 71° F, with about 80° F being optimum. Spawning generally takes place in secluded semidarkened areas under rocks, in log jams and other protected sites (Miller, 1966). Catfish prefer habitat conditions associated with deep holes and large log jams, feeding in shallow water at night (Davis, 1959). Sampling in the Yellowstone River indicates that shallow backwater areas may be important for channel catfish reproduction. Water temperatures in the backwater areas reach preferred levels sooner than in the main channel.

Deposition of silt in streams carrying a high sediment load greatly changes the environment for certain species of fish by blanketing portions of the streambottom, eliminating potential spawning areas and reducing the available food producing areas. Increased discharge associated with spring runoff results in flushing action which removes the deposited sediments. A discharge which results in an annual cleansing of the streambottom is an important aspect of the stream ecology, particularly for streams which transport large amounts of sediment like the Yellowstone.

Water temperatures in the lower reaches of the river are approaching critical levels, with summer temperatures in the 80's common. Withdrawal of water during this season would alter the heat budget of the river, and may result in lethal temperatures for fish like sauger, northern pike, sturgeon and burbot, or for aquatic invertebrates or forage fish that support them. A study to determine flow/temperature relationships has been designed and contracted for with the USGS. This study will define flow levels at which the equilibrium temperature is realized.

The abundance of food in a river varies, depending on the production area. Greatest production occurs in sections of higher velocity. Kennedy (1967) has shown that fish food is most abundant in areas with velocities greater than 1.0 feet per second. Minimum flow recommendations should reflect physical conditions which would maintain quality aquatic production. By insuring that most of the stream substrate is wetted, maximum benthic production is maintained.

Observations on anchor ice by Benson (1955) indicated that ice formed most commonly in stream sections possessing fast-flowing water, with a gradually decreasing volume of flow. Anchor ice serves as a method of dislodging and scouring of bottom insects, and could result in a loss of invertebrate production. Adequate flow must be maintained during the winter months to retard the formation of excess anchor ice and the subsequent total freeze up of the channel. Fish habitat conditions and needs during the critical low flow period of December through February are totally unknown. However, Chapman (1966) states that winter-regulated density of fish populations is probably related to space necessary to escape displacement or damage by current.

Massive water diversions from the Yellowstone River without regard to providing a minimum level could have a serious effect on water quality downstream from the diversions. With an increase in population accompanying the accelerated industrial development, the amount of organic waste entering the Yellowstone and its tributaries will increase. Currently, approximately 1600 pounds of untreated sewage and feedlot/slaughterhouse waste enter the Yellowstone and tributaries daily (Bovee, 1972). In addition to concentrating the waste load of the river, the decreased discharge would have less capacity for the transportation of waste. Thus sludge deposition would be expected to occur more readily. Therefore, a minimum level of flow must be established which will insure the high level of water quality now present in the Yellowstone River.

Among the major migratory bird species that may be affected by reduced river flows are bald eagles, Canada geese, great blue herons, white pelicans, and several species of ducks. All of these birds use the river during a variety of seasons and for a variety of reasons, including resting, nesting, and/or feeding.

Canada geese arrive on the river some time in early spring, depending upon weather conditions. They begin nesting about the middle of April. During an aerial survey of the river in 1967, 218 nesting pairs of geese were counted. This count was thought to have been quite conservative, because of the time and conditions under which it was made. Subsequent counts on different sections of the river indicate that there may be twice as many nesting pairs, and the trend appears to be upward. Present estimates place the minimum number of nesting pairs using the entire river at 500. Each successful nest usually produces from four to six young (Childress, 1971). Using these figures and a nesting success of 70 percent, annual production on the river may be in the neighborhood of 1,500 to 2,000 geese.

Experience on the Yellowstone and studies conducted on other rivers (Childress, 1971; Dimmick, 1968 and Ballou, 1954) indicate that a large majority of nesting (greater than 70 percent) takes place on islands. There appears to be a preference for smaller islands, less than 1/2 acre in size. Also, geese appear to prefer island vegetation that allows them good visibility along with concealment. This type of site occurs on the upstream point and sides of islands where ice scouring has reduced vegetation density (Childress, 1971).

The effects of reduced river flows on Canada goose nesting are not presently known; however, some possible consequences may be formulated if the nest site selection parameters mentioned above are carefully scrutinized. Abnormally low river levels in spring would substantially increase the average size of islands, which in turn might reduce their suitability for goose nesting. Reduced winter flows might alter or eliminate ice scouring on islands, with the result that vegetation densities might increase to unacceptable levels for nesting. Also, reduced spring flows might reduce the number of islands available for nesting due to the drying up of shallow side channels.

Regulation of water flow resulting from the construction of onstream storage sites might also be detrimental to nesting geese. In addition to the loss of habitat through flooding as reported by Hanson (1971), the elimination of high spring runoff levels would eventually change the morphology of the river. The high spring levels are necessary for the creation of new islands, and they aid in maintaining or slowing down the succession of island vegetation. Abnormally high early spring water levels, which are typical of regulated river systems, might have the additional effect of reducing the number of available islands and flooding other nesting sites.

The potential effects of reduced river flows on the rearing of young geese are unknown. One result would be a reduction in the size and number of backwater areas that may be used for brood rearing.

Fall goose concentrations on the Yellowstone River have been increasing since the mid-1960's. Peak counts for that period on the section of river between Glendive and the mouth of the Bighorn River were from 4,000 to 5,000 geese. In 1973, the peak count for that portion of the river was over 10,000 geese. Reasons for this steady buildup are probably the increase in the amount of grain grown near the river and possibly an increase in the continental goose population.

Many geese remain on the river until it freezes over, usually between late November and the middle of December. Reduced river flows and lower velocities would probably hasten the onset of freeze up, which would shorten the duration of goose occupation of the river. This in turn would decrease the enjoyment derived from the presence of the geese by people who live in the region and by waterfowl hunters.

In 1972, about 13 percent of the statewide goose harvest (all species) occurred in counties bordering the Yellowstone River. If only the Canada goose harvest was considered, this figure would probably exceed 25 percent.

An unpublished study by Hinz (1974) presents a more detailed look at geese along the Yellowstone River from Glendive to the mouth of the Bighorn River.

Many species of ducks use the Yellowstone River during spring migration periods. Although available data are quite limited, species known to nest along the river include mallards, blue-winged teal, wood ducks, mergansers, and cormorants. Effects of lowered water levels on river use during spring and summer by these species are unknown.

Fall waterfowl use of the river is quite variable and apparently dependent upon weather. Mallards are by far the most common species using the river during this period. In the portion from Miles City to the mouth of the Bighorn River, peak counts range from about 15,000 in many years to nearly 60,000 mallards in 1973. One possible effect of low water flows would be a hastening in the date of freeze up, which in turn would shorten the duration of fall mallard use along the river. This would decrease the amount of recreation afforded by these birds.

Species known to winter on open portions of the river include common goldeneye, Barrow's goldeneye, and common merganser. Reduced flows would probably affect these species, because there would be less available open water. Similarly Canada geese, mallards, and mute swans use open portions of the upper river during winter.

Bald eagles concentrate along the entire Yellowstone River during spring and fall. As with other species, quantitative data are lacking, but several impressive counts have been recorded. In early December, 1973, 69 bald eagles were counted along the river from Forsyth to the mouth of the Bighorn River. This count ranks as a fairly impressive one for any state except Alaska when compared to others in the literature (McClelland, 1973; Martinka, 1974). Substantial numbers of bald eagles apparently winter along the upper portions of the river.

The possible effects of reduced river flows on bald eagles are unknown. Large concentrations of eagles in spring and fall may be in response to waterfowl concentrations during those time periods. Ducks are probably a supplement to the main diet of eagles, which is fish. Thus any decrease in waterfowl concentration or fish populations due to reduced water levels in the river might be detrimental to bald eagles.

There is a possibility that eagle concentrations along the Yellowstone may be related to the famous concentrations that occur each fall along McDonald Creek in Glacier National Park. In 1973, eagle concentrations in Glacier Park (Martinka, 1974) decreased about one week before large numbers of eagles were reported along the lower Yellowstone.

Herons arrive on the Yellowstone River from late March through April, depending on weather and ice conditions. These birds nest in colonies (rookeries) high in cottonwood trees along the river. The potential effects of reduced river flows on this species are unknown, but again related to various fish populations.

White pelicans are present along lower parts of the river in spring and fall. One flock of 40-80 of these birds is seen for several months each spring in the area between Glendive and Sidney. As many as 200 pelicans have been sighted using the river in this area, and several smaller groups have been noted upstream. It is not known whether or not these birds breed along the river. Low water levels which result in reduced fish populations would be detrimental to these birds.

From the preceding discussion, it can be observed that while some information regarding the Yellowstone ecosystem is available, substantial research remains to be done, and such research is presently underway. Research efforts currently being conducted on the Yellowstone River include an aquatic ecologist working under a contract with Energy Planning to aid in the siting of Colstrip plants III and IV, an ecological planning unit working on the upper Yellowstone River generally from Big Timber upstream, a research project in the lower Yellowstone studying the migratory habits of the paddlefish, and a research effort into the Canada goose population of the Yellowstone River in the vicinity of Miles City.

In addition to these efforts, several other project applications are pending. These include an application to the Old West Regional Commission to study various aspects of the Yellowstone River ecology and a contract being negotiated with the Bureau of Reclamation to begin investigating life histories of nonsalmonid species in the lower Yellowstone River. We are confident much additional information will be gained in the immediate future, but there is an immediate need to have an application or a flow reservation on record so that future options are not lost by default while the river and its ecosystem are under study.

The Amount of Water Necessary for the Purpose of the Reservation

In specifying the quantities of water being requested for flow reservation, it must be acknowledged that during the present, and perhaps now normal, fluctuations in discharge of the Yellowstone River, there will be times when the river will not be capable of supplying the quantities of water requested. It is our intent in requesting these quantities that under all natural hydrologic conditions, future water use permits be conditioned to cease when river discharges reach the levels requested in this application. When river levels drop below the quantities requested due to existing uses or natural phenomena, we fully anticipate that our requests will not be met. Under no circumstances should these figures be construed to imply that augmenting the natural flow through impoundment of flood waters for later discharge will in any way improve upon the existing natural conditions as we now find them in and along the Yellowstone River.

Certain considerations must be recognized if the flow reservation figures for the Yellowstone are to be meaningful. The recommended flows must approximate the seasonal variations which occur naturally if existing aquatic conditions are to be maintained. It is also important that the requested flows will occur with a reasonable degree of frequency. Finally, life histories of the important fish species of the Yellowstone River and its tributaries are not adequately known, and additional research may dictate changes in the reserved flows.

Flow duration hydrographs, drawn from USGS gage records provided the basis for the requested flow reservations on the Yellowstone River. Monthly flows were identified which were equaled or exceeded 70 percent of the time. The concept is not to insure a 30 percentile flow for the period defined, but to identify the flow at which point any additional diversion of the natural flow must cease. Natural flows exceeding the 30 percent level may be utilized. When natural flows fall below that level, they must be protected from any new diversions. Hydrographs showing mean monthly flows and low flow duration curves were used as checks on the recommendation.

The 30 percentile flow level was selected as a base flow as the result of studies which have found this level to be satisfactory for maintaining existing aquatic conditions. Tennant (1972), through many years of observing stream flows, described a flow greater than 30 percent of the mean flow as a satisfactory fishery flow. An instream flow study in Wyoming determined that a discharge in the 25 percent ADF (average daily flow) range will provide substantially more available fish habitat than a 12.5 percent ADF (Wesche, 1973).

Instream flow values were determined for three reaches of the Yellowstone River as follows: from the mouth of the Clarks Fork River to the mouth of the Bighorn River, from the mouth of the Bighorn River to the mouth of the Powder River, and from the mouth of the Powder River to the Montana/North Dakota state line (Table 1). The values are mean monthly flows which were equaled or exceeded 70 percent of the time, and are shown graphically in Figures 1, 2 and 3. Mean annual discharge of the Yellowstone at Billings, Miles City and Sidney is approximately 5.0, 8.2 and 9.4 million acre feet, respectively. These values reflect the volume of water which is flowing past each point over and above that diverted for domestic, municipal, agricultural and industrial uses already established within the basin. For example, according to USGS records, water has been diverted above Sidney for the irrigation of some 1,250,000 acres of cropland. If the instream flow recommendations were implemented, the annual discharges would be approximately 3.8, 6.3 and 7.0 million acre feet, respectively. Thus water is available to meet the desired instream flows as well as agricultural, municipal and domestic needs. Obviously during periods of extreme low flows, all users will suffer.

Table 1. Instream flow needs in cfs for the Yellowstone River from the mouth of the Clarks Fork River to the Montana/North Dakota state line.

	Reach		
Month	1[1]	2[2]	3[3]
January	2,200	4,000	4,500
February	2,200	4,000	5,500
March	2,600	6,300	7,500
April	3,000	6,300	7,500
May 1-20	6,000	9,200	10,000
May 21-31	11,500	17,000	20,000
June	20,300	30,000	34,000
July 1-20	11,500	17,000	20,000
July 21-31	6,000	9,200	10,000
August	3,800	5,400	6,000
September	3,000	5,400	5,500
October	3,000	6,000	6,000
November	3,000	6,000	6,000
December	2,200	4,000	4,500

(Footnotes, next page)

[1] Yellowstone River from the mouth of the Clarks Fork River to the mouth of the Bighorn River.

[2] Yellowstone River from the mouth of the Bighorn River to the mouth of the Powder River.

[3] Yellowstone River from the mouth of the Powder River to the Montana/North Dakota state line.

The Reservation is in the Public Interest

It is the belief of the Montana Fish and Game Commission that the applied-for reservation is in the public interest. As outlined in our discussion, under no circumstances should this application be construed as a request for flow augmentation through storage. It is merely an attempt to establish a base that to a degree mimics the natural flow pattern of the Yellowstone River and that this reservation be supported by the Board of Natural Resources while additional research on all aspects of Yellowstone River water use is conducted.

Evidence that this request is in the public interest can certainly be derived from the overwhelming executive, legislative and public support given Senate Bill 728, and it is our intent with this application to strengthen state government's position in meeting the intent of that act.

Paragraph 6 of Section 26 contained in the Montana Water Use Act specifically calls for continuing review of existing reservations, and clearly gives the Board of Natural Resources and Conservation the authority to extend, revoke or modify the reservation.

In making this application it is acknowledged that much more precision is needed - precision that can only be gained through additional investigation and research. What is being requested will adequately serve as an interim reservation while the additional necessary effort is being expended.

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STATE OF MONTANA

DEPARTMENT OF
FISH AND GAME

Helena, Montana 59601

January 3, 1974

Mr. J. H. Wright, Director
Westinghouse Environmental Systems Department
Box 1899
Pittsburgh, Pennsylvania 15230

Dear Mr. Wright:

I have received and read portions of the "Applicant's Environmental Analysis" for the "Colstrip Generation and Transmission Project."

Contained in the report in general, and the wildlife and aquatic ecology sections in particular, are many statements that I feel are unsubstantiated by available information. You may recall that the inadequacies of available aquatic information were previously pointed out to Westinghouse, specifically in correspondence to Mr. Peter Bibko of your firm on May 8, 1973. It is recognized that Westinghouse is free to ignore any advice given - which is what was apparently done in regard to limitations of existing data and the aquatic perspective of the impact of power development on the total Yellowstone aquatic ecosystem.

It is, however, quite disconcerting to find myself listed as a "contributor" to the report in question, when in fact my effort was spent in unsuccessful attempts to temper your conclusions and modify the scope of your investigation. While "contributor" was never defined, the obvious conclusion of a reader would be that those listed somehow concur and possibly even have reviewed and affected what the report concludes. This was definitely not the case.

Consequently, for the record, I in no way affected, nor can I endorse Westinghouse's rationalization of the Colstrip project, and since I do not recall authorizing the use of either my name nor this department's services in other than a basic limited biological sampling of the Yellowstone River, I must object strenuously to the apparent way we have been used.

Sincerely,

James A. Posewitz

James A. Posewitz, Administrator
Environment and Information Division

JAP/sd
cc: Carl Anderson, Montana Power

bcc: Keith Seaburg
Bob Martinka
Albert Tsao
John Goers

Exhibit No. "53"

Miles City, Montana
May 8, 1973

Mr. Peter Bibko
Westinghouse Environmental Systems
P.O. Box 355
Pittsburg, Pennsylvania 15230

Dear Mr. Bibko:

The final sampling of the rivers has been nearly completed in accordance with our contract. A 24 dissolved oxygen survey remains.

We will get the final report in as soon as the data and samples are processed and assembled.

Tomorrow I anticipate sending to you the plankton samples and 15 minute fish egg and larvae samples.

Regarding the preliminary data summarization and comments sent you on May 2, 1973, the information was summarized rather hurridly and may contain discrepancies which the final report should catch.

Also in transmitting these data we would like to reiterate an important point previously made by Department of Fish and Game representatives to Westinghouse personnel. Data collection from within the limited time constraints imposed on by Westinghouse has severe limitations. While species of aquatic invertebrates and fish present is established, many of their basic life history requirements are still not adequately understood. Extreme caution must be used in extrapolating these data from other areas since most of it was obtained in studies of impoundment related ecosystems where flows and other factors have been significantly modified. The Yellowstone River, functioning basically as a free flowing river attended by natural extremes of flows, sediment and temperatures presents what in essence represents a unique set of aquatic circumstances. This obviously necessitates extensive study. The spot sampling no matter now intensive and complete reveals only a very limited understanding. Certainly not adequate to predict impact of additional modifications to existing conditions.

Sincerely,

Keith G. Seaburg
Regional Coordinator

KGS:dm

Exhibit No. "54"

HEARINGS EXAMINER: Very well, you may cross-examine, Mr. Peterson.

MR. PETERSON: Thank you.

EXAMINATION OF JAMES A. POSEWITZ

Cross, by Applicants

By Mr. Peterson:

Q Mr. Posewitz, as the administrator of the Environment and Information Division of the Department of Fish and Game, are you a direct employee of the Commission of the Fish and Game?

A The commission is the head of the department, yes.

Q And has the statement which you have prepared and filed in this record been approved by resolution of the commission?

A The statement itself has not been specifically approved by the commission. Our participation in the evaluation was done under contract with the Department of Natural Resources. That contract, requiring a recommendation, was approved by our commission; and much of the substance of what we have in our testimony supports a reservation of flows document that was also specifically approved by our commission, and I believe we are also operating under the policy established in 1970 by our commission relative to the development of natural resources; and our testimony here is, I believe, consistent with that policy as established by the commission.

Q Now as I understand it, three of the exhibits which you have introduced here which are flow studies are filed with the application to the Department of Natural Resources by the Department of Fish and Game. These hydrograph plots indicate in the solid black line the amount of flow which the Fish and

Game Department desires in the Yellowstone Basin for the purpose of the beneficial use of the fish and wildlife; is that correct?

A I believe that line signifies the flow that we feel is desirable in maintaining the fish and wildlife resource of that river.

Q And have you done a study on that, Mr. Posewitz?

A I guess maybe I'd better have a better definition of just exactly the word study. We have, and are continuing to make, a number of observations to substantiate and to gather evidence in support of that specific application, and we have done, oh, I'd say a number of examinations of various methodologies and things of that nature.

Q What data do you have presently to give to the Board of Natural Resources as to the effect on fish and wildlife resources if the flow in the Yellowstone River is below that which you request in your application?

A As far as the quantification, for example, of the fish and wildlife resource, is something that is beyond technology today to achieve. I think in the opinion of the people, I would consider that to be a professional opinion of our researchers working on the river that the quantities requested in our reservation represent a reasonable and an appropriate level to be asking for the preservation of that resource.

Q Are you aware of any other judgments that have been made by individuals who have also studied the Yellowstone Basin which recommend that the flows be lower than you requested in your application?

A Yes, I'm aware that the -- what I believe to have been a witness for the applicants testified that a substantially lower request than we have made would be sufficient to maintain the fish and wildlife population of the river; and I am definitely in disagreement with that specific statement.

Q Have you had any information come to you from any other studies which would indicate that the use of the -- or the instream flows which would accommodate fish and wildlife preservation would be lower than what you have requested in your application to the Department of Natural Resources?

A I'm really not aware of any studies, again specific to the Yellowstone River, that would indicate that we could reduce the amount we have requested without contributing, say to the degradation of the fish and wildlife resource of that river.

Q What plans have the Department of Fish and Game either adopted or have in the works right now relative to projects which would protect fish and wildlife in the Yellowstone?

A Well, we have a number of investigations underway, again searching for precision, in the defense of the flow reservation that we have requested; and, if you would like, I could enumerate from memory perhaps most of the investigations we have underway. We don't have any projects per se, for example, if you are thinking in terms of augmenting flows.

Q I'd like to know what the investigations are, sir.

A Okay, we have contracts with a number of corporations and governmental agencies, perhaps the most comprehensive right now is contracts we have with the Old West Regional Commission through the Department of Natural Resources. We are looking into, under the provisions of that contract, water fowl, fur bearers; Tongue River is also a part of that contract, but back on the Yellowstone specifically, we have a contract with the Bureau of Reclamation under which we are studying fisheries. We are into the second year of a contract with the Tenaco Corporation; that project is directed at aquatic invertebrates. We have a contract with the Fish and Wildlife Service which is directed towards primarily fisheries and the reservation of flow. Question? We are receiving contributions from Colorado Interstate Gas that we're committing to the biological projects, primarily fisheries, on the Yellowstone River. We have a contribution from the Panhandle Eastern Corporation which we are again committing to the fisheries study. We are negotiating with the Bureau of Land Management for water quality and fisheries work in the Yellowstone, and I believe that's exhaustive; I may have overlooked something in working from memory.

Q Now what are the purposes of the investigations? In other words, what are the aims?

A Okay, the aim is to continue to support, if the evidence indicates that we must, the application of the reservation of flows. It is to build a data base recognizing that we are facing this problem and the problem of reservations prematurely. I don't think we should be committing water resources like we are until we have a much better understanding of the biology of the river, and that's what we are striving for.

Q How long would that take?

A It's very difficult to predict how soon research pays off. There are substantial problems in the lower Yellowstone from a biological point of view; in other words, simply the logistics and the mechanics of dealing with a body of water that large requires a development of techniques and methodologies that we are working on. We think we have some of the tools available to us, but I think it's premature to be committing water without a base of minimum under it; and that, of course, is the objective of our application for reservation of flows. It is our best and measured opinion at this time that these levels must be respected and that if in time the information is improved to the point where some water can be committed, it should really stand the test of its biological impact.

Q Well, could you give me an estimate, your best estimate, as to what time frame you're talking about?

A Well, each year improves our capability. I think our opinions are better now than they were two or three years ago. We have people who are on the river almost daily. I think it would be reckless to predict not knowing how much financial resource we would have to commit to the study of the biology. I think you can see from our program that we're piecing this together as best we can, we're soliciting funds from every source that we can; but I just really hesitate to tell you when we can say with a great deal of precision that we can lower or sacrifice water out of this.

Q Could you give me a minimum estimate in terms of when you think the study would arrive at the point where you could make a recommendation in accordance with your application?

A Well, even though I hesitate to do this, I would say that within a period of five years or so we would be much more precise in what we can offer as advice. But there are some things, for example, some very important biological aspects of the paddlefish life history. We think we are on the verge of being able to apply the technique of biotelemetry, and I think that's essential before we say or acknowledge or recognize or surrender some of the peak flows that we are requesting. You will notice in our application we're asking for some high water. That's because all the biological information available on paddlefish indicates we need some high water. Now that need is based on the spawning requirements of the fish, and we know from the literature and from our own observations that they are stimulated and the process of spawning is somewhat keyed to that. Now if we can learn, after identifying the specific spawning grounds, that this may or may not be essential each year, perhaps we can reduce our request for the peak flow. Now to do this we have to find out where they spawn and when the young migrate out and what particular problems they have returning back, say to Garrison Reservoir or wherever they spend the rest of their life history. We have been struggling with the technology, or the methodology, of biotelemetry on paddlefish now for quite some time. We think maybe one more year and we can get it together. We have been disappointed before; I mean research is like that. We try to do the best we can, but there are things that don't always fall into place in the time specified. That could be several years away from us yet, and then again it's also contingent on having the financial resources to keep the research going.

Q Well, did your research efforts which you conducted on the Yellowstone which, I understand, included an aquatic ecologist working under the contract with the Energy Planning Division, I assume this contract that you had with the DNR, come up with any results?

A Well, I think we improved our inventory. We knew what species we were talking about. I think we improved our understanding of the species we're dealing with. We're dealing with, basically, a non-cell mounted resource, a non-trout species, and in our department we aren't particularly long in experience with that, or we weren't prior to the energy question. Now we're committing substantially more money, more people, and we're gaining information rather rapidly on the non-trout species and some of their requirements.

Q Let me ask you this. Am I correct in my calculation that the requested application that you have with the Department of Natural Resources could equal 7,100,000 acre feet of water?

A I believe that's approximately correct, or maybe it's exactly right.

Q And have you seen the figures published in the water study by the Northern Great Plains Resource program where the uncommitted usage on the average annual flow is 8.8 million?

A Yes.

Q And, of course, you take the position that you can't look at the averages, but you have to look at each particular time of the year because it may have a different effect on the wildlife at that time, or the fish?

A Yes, that's right; I think averages offer you little information when you're talking about the limiting factors of wildlife populations.

Q Well, don't averages, however, give you an indication as to whether or not storage capacity can be constructed for energy needs to more or less take care of the other beneficial uses.

A Yes, I think averages give you that indication; that's right.

Q Because certainly you must admit, I think, Mr. Posewitz, that there is enough water flowing down the Yellowstone at some time of the year which can be taken into some reservoir, on an annual average basis, and pond in order to take care of certain flow times?

A I think that's right, but if you're talking about impondment, you again talk about a whole new array of environmental impacts, some of which may be adverse.

Q Are you talking about impondment on stream or off stream?

A Well, I'm sure the evaluation would be different, but each one would have its specific set of impacts, and you would have to start talking about -- or get a bit more specific before, say we were to concur that a storage project was appropriate and would, in fact, benefit our objective.

Q Have you had any contact with the applicants in this case relative to a proposal to install off-stream storage on the Yellowstone in addition to their surge pond?

A I have not talked to the applicant about that subject, no, and I'm not aware that any of my people have talked to the applicant utilities regarding their constructing off-stream storage sufficient, say to meet their needs and to respect our reservation of flow application.

Q Yes, what would be, what you say, the adverse impacts on something like that, off-stream storage?

A I think the adverse impact, again, is a cite specific thing. You'd have to look at the area proposed for inundation. I suppose environmental impact also goes to the energy and one thing and another it takes to achieve that, and to their total capacity, you know, the length of time that they could sustain a power project without returning to the river for replenishment.

Q Yes, the capacity of the storage to run the plant?

A Yes.

Q It's a fact, is it not, that under our statute which you deal with in the use of the water that there are a whole list of beneficial uses which have been codified and protected by statute, one of which is fish and wildlife?

A Under the Water Use Act?

Q Yes, sir.

A Yes.

Q And also to be considered are the uses for agriculture, domestic water uses, industrial uses, irrigation, mining, municipal power, recreation, and the like; is that correct?

A Yes.

Q And all of those uses, one has not been given priority over the other?

A That's my understanding, yes.

Q But all have to be considered one along side of the other; is that what you're saying?

A To the best of my knowledge, and again I wouldn't want to debate the law with an attorney, but I think that's my understanding.

Q And if the Fish and Game sees fit to take an average flow of just over 7,000,000 acre feet when the annual average is 8.8 million, that doesn't leave much for the other uses; does it?

A It leaves a lot of water for the nonconsumptive uses. In the question of the consumptive user, that's right.

Q Now we are a nonconsumptive user.

A Yes, I understand that.

Q Now the consumptive uses would be agriculture, irrigation?

A Irrigated agriculture, sure.

Q Probably mining?

A I guess I'm not sure of the type of mining, whether we're talking about -- you know generating power is part of the mining -- or whether we're talking about mineral processing; I would say metal work.

Q Yes, I would say taking water for smelters and things of that nature?

A Yes, most of which I see is being a recycled thing, in the makeup quantities is what we're talking about loss.

Q Some of it would be consumptive?

A Yes.

Q And, of course, another consumptive use would be domestic use of the water?

A To a degree, there's also a return flow there, and I couldn't quote you exactly what the loss is, say with a community of a certain size, but there is a return flow there. A lot of that is nonconsumptive, although like lawn and garden there is some consumptive loss there.

Q Have your people undertaken to establish an inventory of the present uses of the Yellowstone Basin?

A We feel that the inventory of present users is being established by the Department of Natural Resources, and we are trying to coordinate with them in the Zolas project, again taking the deficient wildlife impact as our particular area of operations.

Q In the Northern Great Plains Resource program water study, which I believe you participated in?

A Not directly, although I have reviewed some of that material and have prepared commentaries. I don't know how strong my powers of recollection are to it again, but I was associated as a reviewer of some of that material.

Q They estimate that in 1970, I believe the total depletions from the Yellowstone were about two and one half million acre feet; and they stated that the estimated undepleted flow was about 11,235,000 acre feet leaving the 8.8 million subject to other uses. Now if one works with that figure, wouldn't it be a fact that the amount of water sought by the applicants in this case of what you state is 15,700 gallons per minute for Colstrips 3 and 4 would be a very small percentage of what you people yourself have requested in your application?

A It's a relatively small percentage when viewed in the context of itself, yes. And again our whole arguement is based on the premise that we can't go one slice at a time through the loaf, so to speak; we have to view these things in the context that there is a high demand for water.

Q The total consumption of water for units 1 through 4 running at 100 percent load has been found to be approximately 40,631 acre feet?

A Okay, I'm used to dealing with like 59 cubic feet per second.

Q Yes, about 56 or 56.15.

A All right.

Q Certain people deal, I don't know, in different values, and I'm trying to get for the record these figures straight for everybody's benefit. That would be approximately 25,187 gallons per minute. Now the 40,631 acre feet is a very small percentage, is it not, of the 8.8 million which on an annual average basis is available in flow of the Yellowstone?

A Yes, but again the limiting factors of aquatic communities are generally not operating when you are at an average flow. I think our concern is for the minimums of record, both summer and winter.

Q And as I understand it in your application for the winter months in December, January and February, on the second reach you request approximately 4,000 cfs; is that right?

A That's right, that's correct.

Q And the applicants in this case seek 35 cfs for units 3 and 4 which is less than 1 percent of what you people say you need to preserve the fish and wildlife?

A Okay, I think now in reading our reservation, we do acknowledge that there are going to be times that there will not be sufficient water in that river and, of course, that is the time of stress and that is the time when your biological communities start suffering damage. Any quantity of water, we feel, that we commit from down below that minimum is going to contribute to the degradation of the river itself. It's going to be very difficult to find, you know, who has the last bucket. We think we have to start regulating with each applicant under every opportunity that we can to respect those levels and to minimize the degradation by not being dependent on the river during these times when the natural flow, or when the flow of the river gets down below that point we have specified.

Q And that would also apply then to the withdrawal of water for other uses, such as domestic water supplies, agriculture irrigation, or the like?

A Well, I think any consumptive use when you're down at a low flow level is going to contribute to the reduction of the aquatic communities, yes.

Q Now that's what you mean by stating that at the time that the river gets to that level, each consumptive water use demand must be either denied or reduced down in order to satisfy that river flow for the benefit of the fish and wildlife?

A Yes, I think that's what we mean at that point.

Q Do you have any data, Mr. Posewitz, that if the applicants do, in fact, withdraw 35 cfs during January, February, or December, that the fish and wildlife will, in fact, be damaged?

A I think the winter withdrawals are one of the biggest areas where precise understanding is needed. What we know from aquatic communities is that through, as you might suspect, through the open water growing season your biomass is building in your growth period.

Q Is that the fall season?

A Well, that is from open water early in the spring clear on through to freeze-up. You are building your populations, and over the winter period, you are again reduced to the caring capacity. Now the precise agents that are operating under the ice, as you might imagine in something as large as the Yellowstone, or even the small streams, are one of the biggest areas of research need. But we do know that in streams where we have, where observations have been made on the caring capacity, that it is at the lowest level; in other words, it has suffered its population losses and the caring capacity is established during that period. So it's, apparently, the most sensitive time of the year.

Q Do you know how many days, for example, in December where you would anticipate that no water should be withdrawn from the Yellowstone? On a historic basis, have you made that kind of an inventory research?

A Well, I think in our flow application again we take our best shot based on the information we have, and any day when it's above that line. Now we have, you know, drawn the exceedence curve, and what we are striving for is a level that's exceeded normally 70 percent of the time. So I would say 70 percent of the time, or 69 percent of the time, there would be water available.

Q What data do you have available for the board to say that 2,000 cfs wouldn't be satisfactory at that period of time?

A Well, I think you're talking about again a degree of quantification that just -- you know, the technology for quantifying that thing in the Yellowstone River at this time is not available. What I would, I guess, offer as our reason for that is when you take a water level that is -- I mean any particular degree, whether you say 2,000, 3,000, or 4,000, you're beginning to ask for quantification that no one can supply. The argument -- let's see, you said 2,000 cfs?

Q Just one half of what you've requested for the period.

A Okay, then I think what you would look at, what I would have to look at to respond to this would be the number of times that particular water level is present in the river on natural conditions. And again these aquatic communities are changing annually as a function of how much habitat they've got available to them plus other forces, and to say that we would accept, if we could for point of discussion, say that that is a level that is exceeded 90 percent of the time rather than 70 percent of the time, that means we would accept the lowest 10 percent of the river's potential as something we'd want to establish as the level that we begin to defend. I think that would be accepting just too much of a loss. I think we could ask for better.

Q Have you quantified it in relation to a percentage as to 2,000 or say 1,500 cfs, or have you just done your figures on the 70-30 percent on the basis of the 4,000, your present application?

A The present application we have identified exceedence levels there for 80-20, the median, and then drawn our application in there which approximates the 70 percent exceedence level.

Q I see. Actually that application which you have filed has a purpose, does it not, of allowing you to appear before the Department of Natural Resources and any application dealing with the river flows or withdrawal of water from the Yellowstone so that your position may be maintained; is that right?

A Well, if it is granted, it would do that, yes.

Q And we've got to be careful to understand that at this particular time it still is an application which has not been acted upon by the board?

A That's correct.

Q Now one other thing that is important, is it not, is that there are existing water rights on the Yellowstone River which are protected by law, the Water Use Act itself?

A Yes.

Q And you recognize that those existing water rights take priority over your application?

A Yes.

Q Have you quantified what those existing water rights are?

A I would say that no, not what the existing water rights are. I think that's again part of the process that the Department of Natural Resources is going through.

Q Would they, in your opinion, equal or be around the 2,435,000 gallons which are presently being depleted from the Yellowstone on an annual basis?

A Okay, I think the current flows and the, say, the modern end of our hydrographs reflect water available after all the present users have their rights honored. I'm not sure I'm responding to your question correctly.

Q Well, I guess the answer is that you don't know as far as the Department of Fish and Game is concerned what water rights are protected on the Yellowstone at this time? You don't have an inventory of those water right users?

A I don't have a quantification. I think that's one of the main objectives of the Department of Natural Resources at this time, but again those existing rights and historical uses are reflected in those hydrographs.

Q Wouldn't you say, Mr. Posewitz, that there is enough water flowing down the Yellowstone to take care of all of these uses, within reason, for the beneficial uses as defined by statute?

A Do I think there's enough water -- just so I understand the question correctly -- in the Yellowstone River to respect all of the existing uses?

Q Plus what you have requested in your application and what's considered in this application before the board for the applicants?

A Not in the extreme, no.

Q Now what extreme?

A I think when you're talking about the minimum flows, I think in times when the hydrologic cycle again on a natural basis, assuming we have a system similar to what we're looking at now, say no mainstem impondments, that there are, in fact, going to be times of shortage. I think in 1961, I think it was a very difficult year not only for agriculture, but for the wildlife and fisheries community of the river. It was just --

Q Now in that regard, do you have any data as to what effect that low flow in 1961 had?

A No, in 1961 there was no one working on the river.

Q Okay.

A With the exception -- I guess 1961 is when we first began, maybe it was in '62, but about that time, picking up paddlefish activity and intake. But it was not a comprehensive study by any stretch of the imagination.

Q Was there any study -- there was some study as to the effect on the fish and wildlife; was there?

A Not as far as the effect of the drought condition, to the point where you could quantify, say a certain degree of loss in the biomass out there, no.

Q So you don't know whether or not there was, in fact, a loss in the biomass?

A No, I think you assume that when that much of the river bottom, for example, is exposed, areas that you know from experience and through literature to be the food producing areas of the stream, it's like, you know, losing so many acres of your pasture; and it is quite certain that the production of the river was reduced.

Q And do you think that the production of the river then recovered in the succeeding years when the drought condition cured itself?

A Yes, that's right. I think what we're saying here is that we do not want to commit to a process that increases the frequency and occurrence of those kind of depletions.

Q In the event that the applicants in this case were able to show that they had a storage capacity of at least 19 days of operation in the summer time and 26 days in the winter time when no water would have to be withdrawn from the Yellowstone, would that be a consideration which you would give as to whether or not there could, in fact -- this application would, in fact, affect the ecosystem of the river?

A I would think that would be inadequate.

Q What would you think would be adequate?

A Well, I think there are times, if you're to respect our flow reservation, that a consumptive user would have to have an alternative source of supply for an entire year. Now I don't know how frequent you could anticipate years running consecutively in there, but without that option there would only be one option, either to shut down the plant or deplete the river in some of the years below what we have requested. Now we recognize that under natural conditions we're going to be into that area at times, and what we're arguing is that we do not want a number of consumptive users dependent on the river when we experience those periods.

Q What if another alternative was to utilize as a trade some of the water which is under contract in the Tongue River Reservation?

A Well, there you have a storage capacity, and again it's going to have an impact there, and I have not --

Q You haven't assessed that situation?

A No, not as far as its impact on Tongue River Reservoir, and assuming that a natural, say a sequence of dry conditions that took the river down to that level would also be affecting the Tongue. I mean you would have to make those assumptions or go to historical record to indicate that yes, those things go in unison.

Q Did you people take any position before the Board of Natural Resources on, excuse me, not the Board of Natural Resources, the Board of Health, on units 1 and 2 and the storage capacity or the water use for units 1 and 2?

A I can't recall if we specifically sent a comment over to the department or not at that time; I'd have to check my files, it's been awhile.

Q Let me ask you this then. Assume that the storage capacity for the four plants equal 50 calendar days for the year. Would you consider that to be inadequate also?

A Well, it's an improvement; again we're getting into talking about a question of degree, and I would have to admit that that is an improvement and that my options were getting a bit better. But you'd still -- well, I'd just have to say that that 50 days does not seem like an unreasonable period on the very bottom of the cycle.

Q Usually haven't you found the fact to be that in the winter months when the ice is accumulating on the river that the jams do not last for a period of more than 7 days?

A The thing I don't know is what is really happening to the space available for the aquatic community when those jams are occurring. You know, I just don't know what that looks like under the ice.

Q I see.

A And the only thing we know about that period is that it is really when the major reduction, at least in the fish populations, is occurring.

Q Well, that being a fact, I assume that the only way you are ever going to know that is through actual investigation at the time that that condition arises.

A Yes, we're trying to do some of that in the Tongue River now because it's more --

Q A lower flow?

A Yes, there's less risk. I mean I am just not about to send somebody down into the Yellowstone River through the ice.

Q In other words, you wouldn't undertake any investigation on the Yellowstone Basin to determine the effect of the fish and wildlife in the event of a low flow in the winter time, say of 900 to 1,500 cfs?

A Oh, no, I think we have to start doing that; we have to develop a methodology whether it's -- I didn't mean to imply we were going to ignore that particular problem, but I think we have to start looking at some of the conditions under the ice, things that we can safely do from the surface through some remote kind of observation. But we have initiated as part of the old -- I believe it's part of the old west, but there was also an EPA grant, I'm sorry, that I didn't mention because it was up on the Tongue River, but it was either under that grant or under the old west provisions that we are trying to better understand precisely what occurs under the ice in the winter time.

Q And, of course, in order to precisely understand that, we are going to await a situation where we have those stream flows under that ice situation?

A Well, I think we can pick up some indications under maybe more normal situations, but I think it would be less speculative if we did, in fact, observe those conditions and determine what factors were actually operative in the winter time.

Q And is it then the department's position that until that data is collected, all applicants for water use on the Yellowstone should await until that data is in hand?

A Or develop and plan with the option to respect what, in our opinion, is a legitimate level for a flow reservation, until research and maybe even just some more information indicates to us that it will be all right if you go below that. I don't think we should run that risk until we have some better indication of just what we're going to cause to happen, or create a dependency.

Q Well, would that mean that all consumptive use of the Yellowstone waters are going to have to await a determination of that data?

A Well, it is my opinion they should have an alternative to a continual dependence on the Yellowstone until we know what we are doing, yes.

Q And what would that alternative be?

A The most obvious one is to get in a different watershed where there is substantial storage capacity, say would be the one that comes to mind first, or to -- you see the Yellowstone

River is essentially a free flowing river, and there are many people in this country who are committed to preserving those kinds of assets or amenities.

Q They don't want to dam it up, do they?

A I haven't encountered very many people on the Yellowstone who are of that mind. I think that is the sentiment, yes.

Q And what other alternatives other than a different watershed, are there any others?

A Well, to me that's the most appealing. There, obviously, are alternatives to capturing flood flows perhaps someplace where they're in excess of what the present demand is for them. But I don't know if you can get the quantities right there at Colstrip; then again the ground water options, say the deep aquifers, I'm not well versed enough to know whether or not that would be a viable alternative. That would take more investigation than what I have at my disposal.

Q Maybe we could advocate the construction of the Allensburg Dam?

A You could advocate that if you chose.

Q You don't?

A No, sir, I do not.

Q And neither do we.

A I know that you don't.

Q But wouldn't it be a reasonable approach at this time to say that the applicants could maintain the river flow at no less than 1,500 cfs and also have adequate storage capacity if it ever -- that there was some data by your department through these studies where no withdrawal should be permitted based on that data, up to 4,000 cfs?

A Excuse me, I understood the initial part. The level you are suggesting is 1,500 cubic feet per second as the minimum?

Q Yes, and I'm suggesting now would it be an alternative to say that once you've developed data where you could show that the damage was done below 4,000, if you could show that, that there would have to be an alternative source developed, or additional storage capacity, because based on the present knowledge we just don't know?

A Yes, well, I would hesitate to commit the river to that level, yes. I would say that our best judgment are the levels that we have identified, and until data proves that they are wrong, I think that I would have to say that those are our minimums, what we'd like to see as minimums.

Q Okay, and the data that you've developed for those flows is exactly what?

A I think the basis of those levels is a reflection of what has normally occurred at least 70 percent of the time, and the professional opinion, if you would, of the fish biologists who have worked all along that river, and there is quite a bit of that in this at this time, but I think we are making an honest effort to work towards more precision. In fact, we are doing all that we can with the resources we can find. It's not that we're pointing out these figures and walking away from the problem.

Q Can we summarize then that 30 percent of the time, or rather 70 percent of the time, there will be sufficient water even under your application to take care of all of the uses?

A That is our feeling at this time.

Q And the more off-stream storage capacity or reservoir capacity put in by the applicants to take care of those days that occur within the 30 percent of the time lessens that percentage, doesn't it? It makes it better for the 30 percent of the time when there should be no withdrawal?

A On a strictly water availability question, but here again I want to hedge degree by saying that when you talk off-stream storage that you are starting to involve other factors that have to be looked at on an individual basis, and certainly it is our feeling at this time that off-stream storage is a better alternative from a fish and wildlife point of view than mainstem impondment.

MR. PETERSON: I have nothing else.

MR. SHENKER: May I have a few minutes, Mr. Davis?

HEARINGS EXAMINER: Yes, sir.

(Brief recess)

Redirect by Department of Natural Resources and Conservation

By Mr. Shenker:

Q Mr. Dunkle; now I've blown it; son of a gun.

A I've got to quit smiling.

Q Couldn't be a sharper contrast. Mr. Posewitz, early in your conversation with Mr. Peterson he was asking you about whether you'd heard other folks look at the water flow problems, and whether you thought there might be some other studies around, and you said that you knew that there was a witness who testified on behalf of the applicants, I blew his cover I'm afraid, but do you know who that witness was?

A Yes, that was Mr. Frank Dunkle, former director of Fish and Game.

Q All right, Mr. Posewitz. Now Mr. Peterson let that pass at that point where you pointed out that you disagreed with the position that Mr. Dunkle took, but I wonder for the record, sir, just to sharpen these issues up, can you tell us why you disagreed with the positions that Mr. Dunkle made in his statement?

A Okay, I think specifically on page, at least the page of testimony or record that I have numbered 39-49, in lines 22 through 24, Mr. Dunkle suggests as his professional opinion that water flowing by Nichols at this point judged to be at a daily minimum flow of 900 to 1,100 cubic feet, which would appear to be historical, is a pretty good minimum flow or above a minimum flow; and my concern there is selecting a point near the historical low and saying that's as good as you want the river ever to be.

Q What's wrong with that?

A Well, I think it's like yourself being ill and saying that's how I want to feel forever. I don't think we should plan to sustain a river at its point of most severe stress. I think we have to endure those periods of time, not plan for them and strive to achieve them on purpose.

Q If there is any inference that should be drawn from a fair reading of Mr. Dunkle's testimony, that he, in fact, relied upon the documentation available in the studies of the Fish and Game Commission, what would be your view with respect to such an inference?

A Okay, those implications in the cross-examination, and here specifically again in the documents that I read on page 3916, line 21, and on page 3952, lines 18 and 19, one could derive the implication that data used in his analysis was information coming from the Department of Fish and Game; and I really have no knowledge, in fact, I'm quite confident as I testified under cross-examination here that the lack of data is really what our problem is, and that no inference should be drawn that any information we have supports the contention that we can continue to deplete the water supply of the Yellowstone River.

Q Mr. Peterson was asking you if it wouldn't be a pretty nifty reasonable alternative to go ahead and have the Board of Natural Resources and Conservation certify the Colstrip units and then as a result of studies which you may do in the course of the next few years ahead, you find out that by gosh there are some problems with their having drawn the water down to a point where damage is calculable, then alternate water sources can be found and some other way can be achieved to meet the problem when it has loomed up in a clearer, more concise and precise way. What's wrong with that, if anything?

A Well, again you are looking at an alternative that we really can't see and evaluate. If, for example, the off-stream storage, which was suggested as a potential alternative, I think before you make a decision on something like that, you really have to look at what that option really means, or if the option becomes mainstem storage, of course, we'd be way better off, well, maybe not way better off, but that would require substantial analysis; and again there seems to be a lot of debate over just what the impact of withdrawing deep or even shallow ground water is concerned. I just don't think one should commit these things to a solution that is not at hand, and that if they are built, that the alternatives have to be built at that time. There have been cases in the past where you have run up against a simple alternative of look either we go ahead and do environmental damage or shut down the plant, and here's all these people with a dependency that we've created and it really becomes no alternative at all.

Q Well, consistent with the alternative as Mr. Peterson put it to you in his question which you can consider as certify now and worry later, he also asked you whether it wasn't your position that 70 percent of the time things are just sort of hunky-dory in water flows, and 70 percent seems like more than a majority of the time so why are you concerned?

A Well, we are concerned because when you look at that 70 percent exceedence curve, you get down to a river stage that occurs about 30 percent of the time. Now at that time we feel that we are not producing fish and wildlife resources, the basic productivity is affected. We are not producing anything like we would be, say at a level above that, and I think to establish these things and then actually plan and go down and establish a permanent degree of degradation is iladvisable.

Q Even only 30 percent of the time?

A Well, I think so, yes. I mean we, in essence, say that that's the absolute bottom and everybody has got to make a sacrifice when we get to that level. Now I wouldn't want to see the river permanently at that level.

MR. SHENKER: I have no further questions. Thank you, Mr. Posewitz.

HEARINGS EXAMINER: Mr. Peterson?

Re-cross, by Applicants

By Mr. Peterson:

Q Mr. Posewitz, you've been working since 1961 at the Fish and Game Department; how many applications have you worked on since that time for reservation of stream flows, other than the Yellowstone?

A Oh, we have a number of I guess what you might consider minor applications for a flow reservation. We have one in on Prickly Pear Creek, we have one in on the east fork of Blacktail Creek, and we have a number of others that we are in the process of preparing.

Q Was the application you prepared for the Yellowstone River precipitated by the announcement of the application to construct Colstrip units 3 and 4?

A No, our concern for the Yellowstone was based on the general and reasonably well documented interest by a great number of people in developing the Fort Union coal reserves.

Q When did that project begin in your department, what year?

A The actual submission I think -- I couldn't tell you the exact date that we began developing this flow reservation for the

Yellowstone River. I think the date of submission is on the front page, but I couldn't tell you exactly at this time when we decided that this is what we'd have to do.

Q Well, I understand --

A It's March of '74.

Q That's when the application was filed?

A The application went in, or was filed, right.

Q And as I understand it, you made the decision some time prior to that?

A Yes.

Q And do you know when?

A I can't give you the precise date, but -- well, let's see, when was the -- the effective date of the Water Use Act was July of '73?

Q That's the best of my recollection.

A Yes, and I would say at that point we decided that there would have to be something done.

Q And so from July of 1973 under March 15 of '74 is when you undertook to prepare your application?

A To get it together, yes.

Q And prior to that time you had not done any work on the Yellowstone as such?

A Well, we had been working on the Yellowstone prior to that, primarily in the upper reaches, but we were also doing some management related work on the lower ends.

Q What was the purpose of that work?

A Okay, on the upper Yellowstone there was a law, and again I'm testing my memory, but to the best of my recollection there was a law passed in 1969 introduced by Senator Murphy of Kalispell, and we have come to know it, at least internally, as Murphy's law, and not in the derogatory sense certainly; but in that year when that law was passed, we were given the opportunity to file for a water right in portions of 12 streams. One of those was the upper Yellowstone River, and so we began looking at flows in order to respond to that, and did subsequently file for water rights in the county, and that would be again to the best of my recollection, in Park, Sweetgrass, and Stillwater Counties.

Q What flows did you file on there?

A Again I can't recall exactly, but I think we were in the 2,000 per cubic foot range, and they were also seasonably adjusted and I would want to go and view the documents again to give you the exact quantities.

Q And did you consider at that time that those were the flows which were suitable to protect the fish and wildlife?

A In the upper Yellowstone, they were the best we could come up with at that time given what was available.

Q Now with regard to whether or not the river should run at below the 30 percent mark, as I understand it in your application, what you're saying is that when the natural flows exceed the 30 percent then the river may be utilized, and when they don't you want it all reduced or shut off?

A Basically, I think we're accepting that to a degree, although, like I say, it's something we feel in the natural hydrologic cycle you would not create a dependency that would cement that thing. There would be years that you would flow above that, but we think when it gets to that level, we would like everybody to have an alternative.

Q So that we can be clear, your first priority as far as the water use of the Yellowstone is concerned is to protect the fish and wildlife?

A Yes.

Q And that's your job?

A Yes.

MR. PETERSON: That's all I have.

Re-redirect, by Department of Natural Resources and Conservation

By Mr. Shenker:

Q Mr. Posewitz, on the Water Use Act, its effective date was July 1, 1973, but it was passed in March of 1973. With the passage of that act, did you not then know that you would be filing the application which you have suspended to your statement here?

A Recalling that far back, I don't know exactly what my thoughts were at that time, but we certainly saw the pressures of the Yellowstone very early, and we were involved in a number of interagency task forces and, I believe at that time, we had documents like the North Central Power Study that clearly forecast substantial environmental changes and substantial doing that and to filing this application even though the moratorium was in place, and he concurred that that would not bother him at all; and then we went ahead and filed.

Q The application for the Colstrip units 3 and 4 was filed on June 6, 1973. Was that the date that triggered you into action where you previously were inactive?

A No, I don't think so, no. We were worried about the Yellowstone back in 1969 and prior to that when many of the legislative records show that we were arguing to be recognized as a legal beneficial user of water without diversion. As soon as we even had limited authority on limited sections of 12 streams, we proceeded with, I think, as much diligence as we could and made those filings to the limit and extent that we could.

MR. SHENKER: Nothing further. Thank you, Mr. Posewitz.

HEARINGS EXAMINER: Anything further, Mr. Peterson?

MR. PETERSON: No.

HEARINGS EXAMINER: Any objections to the exhibits that have been proposed and offered?

MR. PETERSON: I have no objections to Exhibits 49 and the hydrographs 50, 51, and 52?

HEARINGS EXAMINER: I don't know, I don't have those.

MR. PETERSON: Yes, 50, 51, and 52; I have no objection to those four exhibits. As to Exhibits 54 and 53, I will object to them on grounds that they are irrelevant to the issues in this proceeding.

HEARINGS EXAMINER: Very well, objection is overruled. All exhibits will be received, and I might advise I don't have copies of Exhibits 50, 51, and 52, so I'll have to be furnished copies.

MR. PETERSON: Well, I think they left copies with you.

HEARINGS EXAMINER: In some of the copy of the other exhibits that are on my statements are not very legible so maybe we'll get some better ones. You are excused and thank you, Mr. Posewitz.

(WITNESS EXCUSED)

HEARINGS EXAMINER: Now we have two public witnesses that I told them we'd stay here until we get through with them this afternoon, and I guess, counsel, you're all set so you don't have to call home and get permission or anything to be late. Mr. Crosby?

RULON CROSBY, appearing as a public witness, having been first duly sworn upon his oath, both as to his written direct testimony and as to the oral testimony to follow, was examined and testified as follows:

(THE WRITTEN DIRECT TESTIMONY OF MR. RULON CROSBY WAS DIRECTED TO BE INSERTED AT THIS POINT.)

Rulon
CROSBY

**Westinghouse
Electric Corporation**

949 South Montana Street
Box 3179
Butte Montana 59701
(406) 792 2301

February 17, 1976

Montana State Board of Natural Resources
c/o Hearing Examiner Carl Davis
State Capitol Building
Helena, MT 59601

Gentlemen:

I would have preferred to give oral testimony before you. I do, however, understand the constraints that make this impossible.

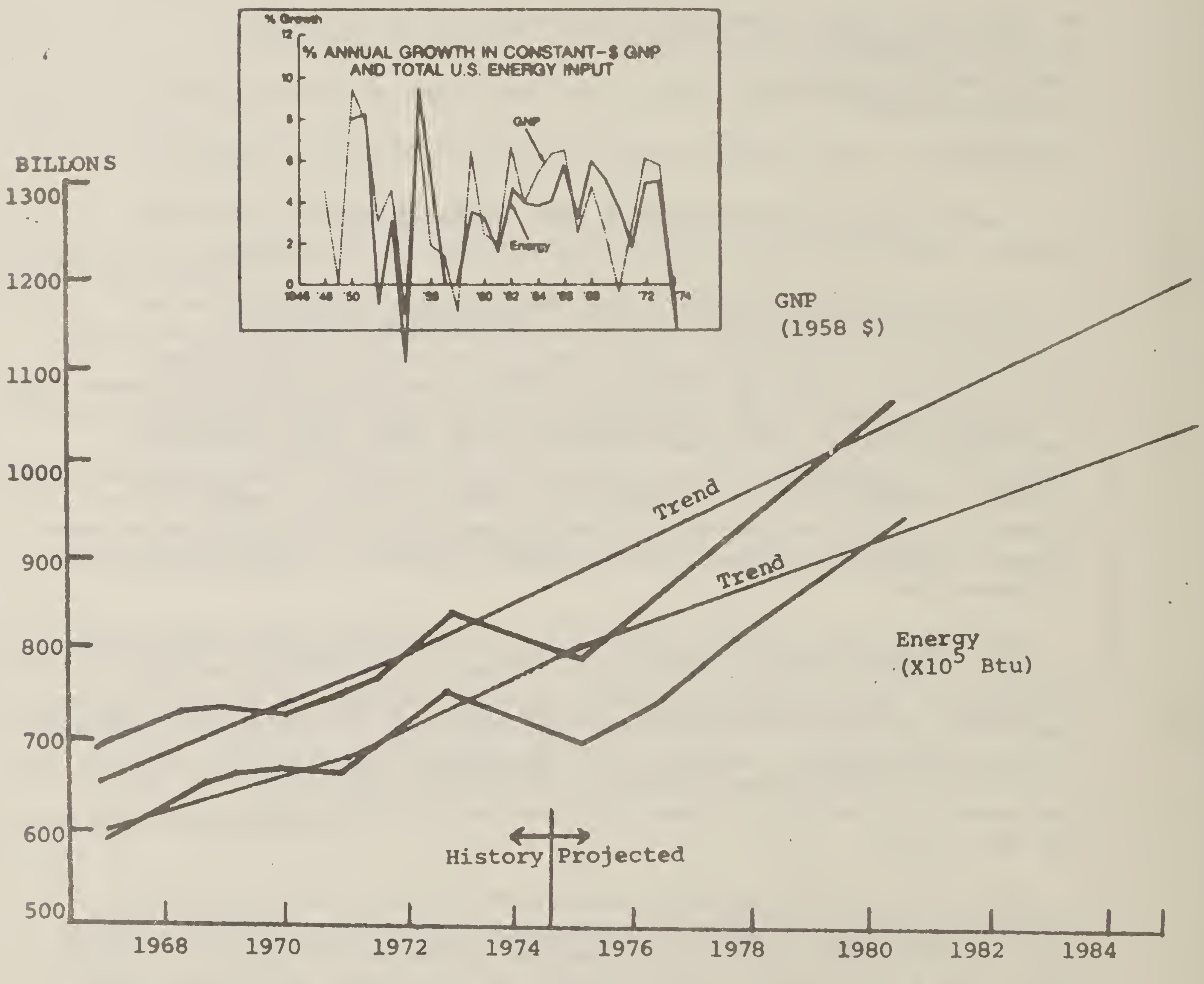
It is my sincere conviction that the electricity which could be produced by Colstrip Units 3 & 4 is needed to help sustain the economy of our country and is even more important to the economic well being of the State of Montana. Now as you can see by the two following charts (next page) the growth and decline of the energy usage in the United States coincides almost exactly with growth and decline of the Gross National Product. Indeed it is impossible in our industrialized economy for the Gross National Product to grow without a corresponding growth in energy usage. Some separation of the two trends could be accomplished through the use of more energy, effecient processes, and equipment, however a complete uncoupling is impossible.

The major dips below the trend lines in the second graph were caused by the recent recession. Some people, including apparently the State Deparment of Natural Resources have mistakenly assumed that the recession caused dip in energy use represents the beginning of a long term leveling off of energy demand. Nothing could be further from the truth, because as the economy recovers from the recession as it is beginning to do now, the demand for energy will grow even more rapidly than the historic 4% per year trend.

This nation needs adequate supplies of energy to prevent ecomonic stagnation and the accompaning unemployment and lower standard of living. This country depends upon natural gas and petroleum for 80% of its energy needs. As a consequence we are rapidly deleting these resources. The nation has twenty times as much energy available in the form of coal, as in the form of gas and oil, but unfortunately coal cannot be burned conveniently in homes and smaller businesses. Sufficient coal converted to electricity could provide adequate clean convenient energy for everyone and aleviate the problem of overdependency on petroleum and natural gas.

U.S. GROSS NATIONAL PRODUCT

and ENERGY CONSUMPTION



The accompaning document, "Creating the Electric Economy" was taken largely from testimony delivered by J. W. Simpson of the Westinghouse Electric Corporation to a congressional committee. It develops in detail the need to switch to an electricity based economy and the consequences of not doing so. I urge you to consider this information in making your decision about the Colstrip Project. I believe it is very pertinent because as the first project of this nature to be reviewed under the new siting act, it will be precident setting with respect to how western coal will be used to help solve the National Energy Crisis.

The second document, which I authored, deals more directly with Montana's energy situation. It discusses the impending storage of natural gas in Montana caused by past and future forced cutbacks of gas imported from Canada and compares coal gasification with electricity generation from coal as alternative means of supplying Montana's energy needs.

From the findings of this paper one must conclude that converting coal to electricity for home and business heating would be the most efficient and, to the consumer, least expensive alternative. Electric heating is increasing in application throughout Montana. As natural gas rates go up and availability decreases this trend will accelerate.

Montana will soon need all the energy the Colstrip 3 & 4 Plants will be able to generate. Kilowatts go to where the load is, no matter who owns the plants which generate them.

Despite the protestations of well meaning opponents I trust that a rational analysis of all the pertinent factors will lead the Board to conclude that permitting Colstrip Units 3 & 4 to be built would be in the best interests of this country and particularly of the people of Montana.

Sincerely,

Rulon Crosby

Rulon Crosby
Power Systems Sales

/cs
Attachment

SOLUTION TO NATURAL GAS CRISIS
COAL GASIFICATION OR ELECTRICITY?

In June of 1975 Governor Judge declared a "Natural Gas Emergency" for the State of Montana. He did so because the Canadian Government and the Province of Alberta are reducing and threatening eventually to cut off completely the natural gas being exported to Montana from fields in Southern Alberta. This would have a serious effect upon the State because the montana Power Company, which serves 66.9% of the users in the State, receives approximately 85% of its supplies from Canada.

The Canadians have promised to try to stretch gas export reductions out over the next several years to provide Montana sufficient time to develop alternate energy sources. However, Canadian politics and internal needs, which are somewhat unpredictable, will affect the actual cutoff schedule and the price charged for exported gas. The price for imported Canadian gas has gone up six fold in less than two years.

Montana Power Co. has stepped up its leasing exploration and drilling programs in an effort to derive more gas from instate sources. These efforts have resulted in an increase of five BCF (BCF = Billion Cu. Ft.) in 1975 over 1974. Also, Montana Power Co. has announced the acquisition of the Bear Paw gas properties which are expected to begin producing approximately 6 BCF per year beginning in 1977 and continuing for 5 to 7 years at this rate before tapering off.

However, even if the Canadians are as cooperative as could be realistically expected and if Montana Power Co. is as successful in developing additional instate reserves as could realistically be expected, Western Montana will still be faced with natural gas shortages of greater or lesser degree within the next decade. Plans should be formulated now to provide for orderly substitution of other energy resources.

The following chart breaks down the Montana Power Co. natural gas supply by source and usage for 1975.

MONTANA POWER COMPANY GAS SUPPLIES & [illegible]

TOTAL USAGE	57 BCF
CANADIAN IMPORT	41.87 BCF
MONTANA PRODUCTION	15.85 BCF
INDUSTRIAL LOAD	27.00 BCF
COMMERCIAL LOAD	12.86 BCF
RESIDENTIAL LOAD	17.14 BCF*
ANTICIPATED BEAR PAW PRODUCTION BEGINNING IN 1977	6.0 BCF

*Includes Montana Power Co. direct served residential loads as well as residential loads of Great Falls, Cut Bank, Shelby and other smaller wholesale gas customers.

Priorities established by [illegible] Federal Power Commission stipulate that in the event of [illegible] natural [illegible], first industrial, then commercial, [illegible] customers would be curtailed or cut off. As can be seen from the [illegible] chart, the total production from Montana fields would be very nearly sufficient to provide for the existing 1975 residential load. In 1977 instate production should exceed residential requirements. This would make it unnecessary for present residential customers to switch to other fuels because of lack of natural gas caused by an unlikely immediate complete cutoff of Canadian gas. Industrial, commercial and new residential customers would have to find alternative fuel sources.

WHAT ARE THE AVAILABLE ALTERNATIVES?

Montana has vast amounts of energy available in the form of subbituminous coal. Some large industrial users will be able to substitute direct burning of coal for natural gas. This will require sophisticated boilers and pollution control equipment. These requirements plus the attendant inconvenience precludes coal being burned directly in most commercial establishments and homes.

COAL GASIFICATION ALTERNATIVE

The Governor has appointed a task force to study the possibility of constructing a large coal gasification plant to produce enough pipeline quality gas to satisfy foreseeable instate demand. The task force chairman is Jim Hodge. Jim is also head of the Montana International Trade Commission which prepared a report on Montana natural gas alternatives. This report recommended coal gasification. It was influential in persuading the Governor to declare the 'Natural Gas' Emergency and to appoint the Coal Gasification Task Force.

ELECTRICITY GENERATION ALTERNATIVE

The one other most viable alternative would be to convert the energy from Montana's coal into electricity for distribution to the individual consumers.

The following chart shows a comparison of how much of the energy available from the source fuel can be converted into residential space heat.

OVERALL RESOURCE EFFICIENCIES

NATURAL GAS

WELL 100% → GATHERING SYSTEMS 95% → PIPELINE 95% → HOME HEATING SYSTEM 50% = 45 %

COAL 100% → GASIFICATION 65% → PIPELINE 95% → HOME HEATING SYSTEM 50% = 30.87%

COAL 100% → GENERATION 35% → TRANSMISSION & DISTRIBUTION 90% → RESISTANCE HEAT 100% = 31.5 %

COAL 100% → GENERATION 35% → TRANSMISSION & DISTRIBUTION 90% → HEAT PUMP 174% = 54.81%

Actual inhome studies have shown that gas furnace residential heating systems convert on the average only 48% for the heat from the gas into heat for the home. The cold air which must be drawn into the house to replace the air used for combustion and furnace warm up times are factors affecting overall gas heating system performance.

Depending on such variables as the process and the type of coal used, coal gasification should be between 50% and 70% efficient; i.e., for every 100 BTU of energy available in the source coal approximately 65 BTU would be available in the product gas.

Conversion of coal into electricity is not as efficient as coal gasification; however, as a fuel for home heating it is much more efficient. Resistance heating (such as electric baseboard heaters) requires no intake of cold combustion air nor a chimney through which heat is lost. 100% of the electrical energy converted into resistance heat is available for heating the home.

A modern design heat pump is even more efficient than resistance heaters. By using electrical energy to power a compressor, a heat pump brings heat in from the outside air and concentrate it to a higher temperature for space heating. It works like an air conditioners in reverse and can also be used for air conditioning in the summer.

The higher the outdoor [illegible] the [illegible] pump operates. The average annual efficiency of a modern design residential heat pump system in Atlanta, Georgia would be 259%, in Pittsburgh, Pennsylvania 203% and in Minneapolis, Minnesota 174%. The Minneapolis climate is very similar to the climate experienced at most locations in Montana, therefore, 174% was used in the comparison chart above.

Heat pumps have not been used extensively in Montana because earlier designs were not as well suited to our colder climate, and because we have had relatively inexpensive and abundant natural gas available. In other areas where sufficient natural gas has not been available, including parts of Northern Minnesota and North Dakota, heat pumps have been extensively and successfully applied.

Referring to the above chart it can be seen that amount of energy available from the source fuel which is finally converted into useful space heat is about the same for coal gasification and electric resistance heat, but that the electric heat pump has an even higher overall resource efficiency than natural gas heating systems.

COSTS TO CONSUMERS

The next chart is based on present Montana Power Company rates and compares actual fuel costs to the residential consumer.

COST FOR RESIDENTIAL HEATING

NATURAL GAS

15¢ PER 100,000 BTU x 50% HEATING EFFICIENCY = 30¢/100,000 BTU EFFECTIVE HEAT

COAL GAS (ESTIMATE BASED ON 3.00/MCF TO CONSUMER)

30¢ PER 100,000 BTU x 50% HEATING EFFICIENCY = 60¢/100,000 BTU EFFECTIVE HEAT

ELECTRIC RESISTANCE

45¢ PER 100,000 BTU x 100% HEATING EFFICIENCY = 45¢/100,000 BTU EFFECTIVE HEAT

ELECTRIC HEAT PUMP

45¢ PER 100,000 BTU x 174% HEATING EFFICIENCY = 26¢/100,000 BTU EFFECTIVE HEAT

The price shown above for coal gas is a conservative estimate in today's dollars of what gas from a full scale coal gasification plant would cost when distributed to the individual consumer. Many people familiar with the situation feel that 4 to 5 dollars per MCF would be more realistic. (MCF = 1000 Cu. Ft.)

The price of electricity as a fuel is 3 times as high as the price of natural gas and 150% of the projected consumer price for coal gas, but because of much higher heating efficiencies for electric systems the actual fuel cost for electric resistance heat would be 45¢ per 100,000 BTU effective space heat compared to 60¢ per 100,000 BTU for coal gas and 30¢ for natural gas. The heat pump system would provide the lowest fuel cost of all at 26¢ per 100,000 BTU of effective space heat.

Heat pumps cost more to buy and install than conventional gas heating systems (approximately $2200 for an 1800 sq. ft. house for a heat pump vs. approximately $1300 for a gas heating system) but they also provide air conditioning for the summer months. (A gas heating system with air conditioning added would cost approx. $2000.) In terms of both resource efficiency and cost to residential and commercial consumers, converting Montana's coal to electricity and using it to operate heat pumps for space heating appears to be a better solution than coal gasification.

SUBSTITUTION FOR NATURAL GAS USED BY INDUSTRY

Some industrial users of natural gas will choose to switch to direct coal burning. One Portland cement company has already done so.

Other industrial customers [illegible] find it more advantageous to substitute electricity. The metals smelting industry has found that electric furnaces [illegible] control, require fewer people to operate, and result in much less flue gas to be cleaned up than gas or coal furnaces.

The Anaconda Company recently switched one of its large copper smelting furnaces to electricity, primarily to meet environmental standards; however, by October 1975 natural gas rate increases in combination with simplified control and fewer operating personnel will have made the new electric furnace as economical to operate as the gas furnace it replaced. Since there are no resulting combustion products, electricity is cleanest fuel available for both industrial processes and home heating.

COMPARISON OF ELECTRICITY GENERATING AND COAL GASIFICATION FACILITIES:

To be economically feasible both coal gasification and coal-fired electricity generating facilities would have to be relatively large. Costs for either facility would range between 200 and 800 million dollars, and coal requirements would range from 2 to 10 million tons per year. Large strip mines would be required to provide fuel to either facility.

To meet Montana's entire near term demand (with no contribution from natural gas wells) a 220 million cu. ft. per day coal gasification plant would be required. Plants ranging in size from 100 million cu. ft. per day to 170 million cu. ft. per day have been proposed for consideration by the Montana International Trade Commission.

The following chart compares the two options and some of the problems confronting them.

	COAL GASIFICATION	ELECTRICITY GENERATION
1.	NO FULL SCALE PLANTS NOW OPERATION IN THE USA	MATURE TECHNOLOGY MANY PLANTS ARE OPERATING IN USA
2.	FINANCING UNDEVELOPED	FINANCING IS AVAILABLE FROM PRIVATE SOURCES
3.	COULD BE OPERATION IN 1986 (10 YR. LEAD TIME ASSUMED)	COLSTRIP 3 COULD BE OPERATIONAL IN 1981 IF CONSTRUCTION APPROVAL IS NOT DELAYED BEYOND THE END OF 1976
4.	MONTANA COULD NOT UTILIZE THE PRODUCTION OF A 100 TO 250 MILLION CUBIC FEET PER DAY ALL AT ONCE. INTERCONNECTIONS WITH LARGER OUT OF STATE SYSTEMS WOULD NEED TO BE DEVELOPED	THROUGH INTERCONNECTIONS WITH OTHER UTILITIES AND BY PUTTING OLDER PLANTS ON STANDBY STATUS LARGE GENERATION ADDITIONS CAN BE ACCOMMODATED
5.	EQUIPMENT REDUNDANCY AND UNDERGROUND GAS STORAGE WOULD BE NEEDED TO COVER BREAKDOWNS AND MAINTENANCE OUTAGES	SUFFICIENT RESERVE CAPACITY IS AVAILABLE THROUGH INTERCONNECTIONS AND STANDBY PLANTS

The [illegible]

A [illegible] Europe. Since World War [illegible] in this country, be considered [illegible] pipeline quality gas. Pipeline quality gas must have a heat value of [illegible] BTU/Cu. Ft. Most gasification plants produce [illegible] BTU/Cu. Ft. gas which must be upgraded through a methanation process to achieve pipeline quality.

There are no full scale coal gasification plants presently operating, or even under construction in this country. All present gasification plants in the U.S. are pilot units being used for research. Engineers from the Stearns Rogers Engineering Corp., which is deeply involved with coal gasification research, estimate that at least 10 years would be required to put a full scale pipeline quality coal gasification plant into full production.

By comparison the design and construction of coal-fired electric generating stations requires from 3 to 5 years.

RESERVE REQUIREMENTS

It would be possible through interconnections to large out of state natural gas systems (which presently don't exist and would cost a lot to construct) and use of large underground storage facilities to gain enough gas reserve to protect against breakdowns of a large coal gasification plant. The gasification plant itself would probably be constructed of four independant production lines which would reduce the risk of the entire facility breaking down at once. Electric utilities always have at least enough reserve capacity to cover an unscheduled outage of the largest generating station on their systems.

ENVIRONMENTAL IMPACT

The following chart compares the environmental impacts of coal gasification and electricity generating facilities.

ENVIRONMENTAL IMPACT

Coal Gasification	Electricity Generation
1. Large strip mine required to provide fuel.	1. Large strip mine required to provide fuel.
2. Sulfur and ash are removed during gasification process and must be stored on site or used to backfill the strip mine.	2. Sulfur and ash are removed by stack gas scrubbers and must be stored on site or used to backfill the strip mine.
3. Atmospheric emissions consist primarily of relatively small quantities of steam and carbon dioxide.	3. Atmospheric emissions consist of steam, carbon dioxide, and smaller amounts of sulfur dioxide and ash. (Stack gas scrubbers are approx. 99.5% efficient for particulates and 75% efficient for SO_2.)
4. Requires large quantities of water for cooling and to provide hydrogen for the methanation process. (10,000 acre ft./yr. for a 250 million cu. ft./day plant)	4. Requires large quantities of water for cooling. Approx. 30,000 acre ft./yr. for a 21,000 MW complex. The water required to produce the same amount of useful space heat is approx. the same as for gasification.

5. Terrestrial and social impacts are approximately equal for both types of energy conversion.

ATMOSPHERIC IMPACT

On balance, the electric generating station would have a greater atmospheric environmental impact; however, either type of plant should be able to comply with Montana's stringent environmental regulations.

WATER USE

The water use by either plant would not be consumptive as, for example, the burning of the coal would be. The coal, once burned, is gone forever. Most of the water is evaporated and will fall again as rain at another location. Even the water chemically disassociated in the methanation process would be replaced by the water formed when the product gas is burned.

The water used by either energy conversion process would be augmented by spring runoff trapped in a reservoir. Users of water for irrigation, drinking, etc., would not be deprived.

COMPARISON: CANADIAN GAS & COLSTRIP ELECTRICITY

The table below shows how many days of full electrical output for the Colstrip plants, which are being built or have been proposed, would be required to replace the amount of energy available in the natural gas being imported from Canada.

CANADIAN IMPORTS	DAYS OF FULL OUTPUT FOR COLSTRIP 3 & 4 (1400 MW)	DAYS OF FULL OUTPUT FOR COLSTRIP 1, 2, 3, & 4
43 BCF/YR.	374	248
USING RESISTANCE HEAT 100% EFFICIENT	186	124
USING HEAT PUMPS 174% EFFICIENT	107	71

This table is not meant to suggest that electric substitution would be a simple matter. Additional transmission and distribution lines and equipment would be required along with the furnaces, heat pumps and other devices to use the electricity. The table is meant to provide some perspective pertaining to how a project most Montanan's are familiar with compares in energy production potential to the energy presently imported from Canada in the form of natural gas.

ELECTRICAL GENERATION IS BEST SOLUTION TO GAS CRISIS

The evidence described in this article indicates that conversion of Montana coal to electricity would be the best presently available solution to the "Natural Gas Emergency" which the Governor has proclaimed. The following reasons apply:

1. Electrical generation is a mature technology which could provide the required energy by 1981.
2. Heating with electric driven heat pumps would require less of the source fuel (coal) than any other practical alternative.
3. The fuel cost to the consumer would be less for electric heat than for coal gas heat.

ADVANTAGES OF COAL GASIFICATION

Coal gasification and liquefaction programs should be pursued for reasons other than those growing out of a potential cutoff of

Canadian natural gas. There are many uses of our increasingly short supplies of natural gas and petroleum for which electricity cannot be substituted. These include fuel for long haul trucks, busses, and airplanes; feedstock for chemicals and fertilizers.

A coal conversion facility which serves all of these needs in additions to providing some gas to augment our declining natural gas supplies would be easier to justify both economically and technically than one which serves only to replace lost Canadian natural gas. The Circle West Project proposed by the Burlington Northern Railroad, which would produce locomotive fuel in addition to fertilizer, is a good example of the kind of coal conversion facilities Montana should be concentrating on.

CONCLUSION:

Montana needs both coal-fired electricity generation and coal gasification/liquefaction. Electricity appears to be the best alternative for coping with our short term natural gas shortage, but coal gasification/liquefaction promises some longer term benefits which electricity cannot provide. It would be beneficial to Montana if the responsibility of the Governor's Coal Gasification Task Force were expanded to include consideration of all available energy alternatives and recommendation of how these should be applied in a balance which is best for the State.

CREATING THE ELECTRIC ENERGY ECONOMY

THE ENERGY UTILIZATION PROJECT
POWER SYSTEMS PLANNING
WESTINGHOUSE ELECTRIC CORPORATION
EAST PITTSBURGH, PA. 15112

REPORT #PSP 3-21-75

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CREATING THE ELECTRIC ENERGY ECONOMY

Energy problems are profoundly affecting the economy of the nation and the world. But the basic problem is not a shortage of energy, per se, but rather a shortage of the two energy fuels that we are heavily dependent upon--oil and natural gas.

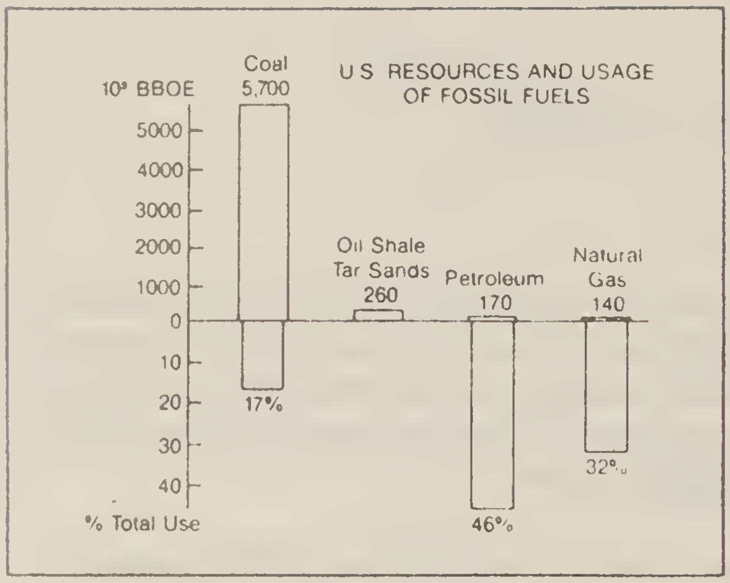
The production of oil and natural gas in this country is peaking out and the exhaustion of these fuels may be a matter of only two or three decades. If our consumption of these fuels continues to grow, we will be forced to rely on imports--a reliance that can have serious political and economic effects.

The logical solution to this dilemma is to reduce consumption of these fuels to the greatest degree practical; yet, increasing consumption of energy is essential to maintain economic growth. This would dictate that we phase in more abundant fuels to reduce dependence upon the fuels that we are exhausting.

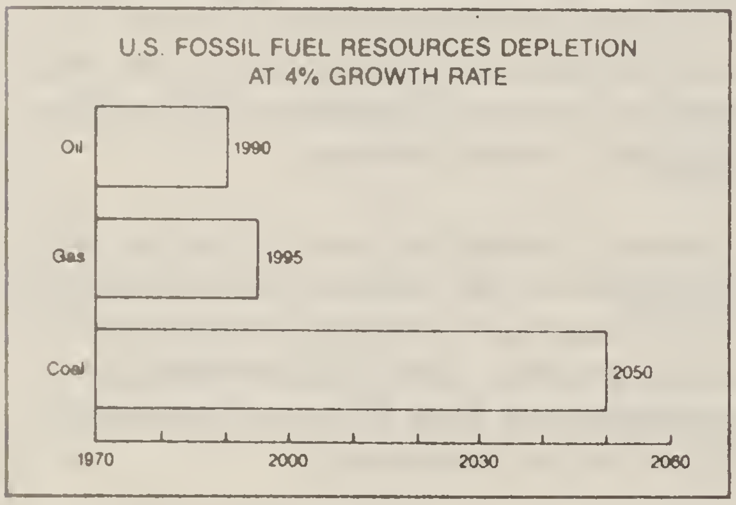
Coal and uranium are the only energy fuels available in abundance. These two fuels have one thing in common--they are normally used in the secondary form of electricity.

Thus, if the nation is to expand its energy base, we must use more electricity wherever possible to replace oil and gas. This, of course, requires two things. First, a host of new products and devices that use electricity must be manufactured and marketed in quantity. Second, an adequate supply of electricity must be available, and this requires that the utility industry build more nuclear or coal-fired electrical generating plants.

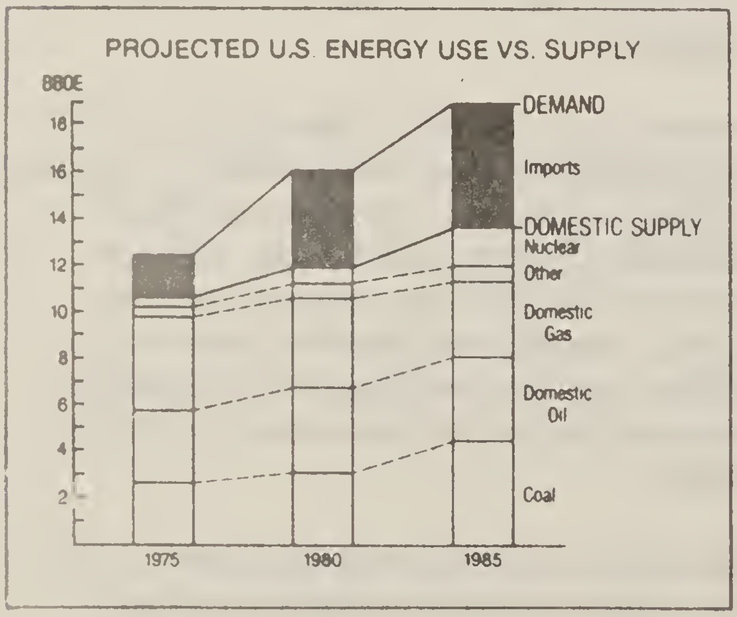
Practically all of the available evidence points to the conclusion that United States production of oil and



natural gas is peaking out as demand for these fuels continues to rise. Unfortunately, the U.S. economy is "overcommitted" to the use of oil and natural gas, as these fuels account for about 80 percent of all energy use in the country. But these fuels represent less than three percent of our total domestic energy resource base.



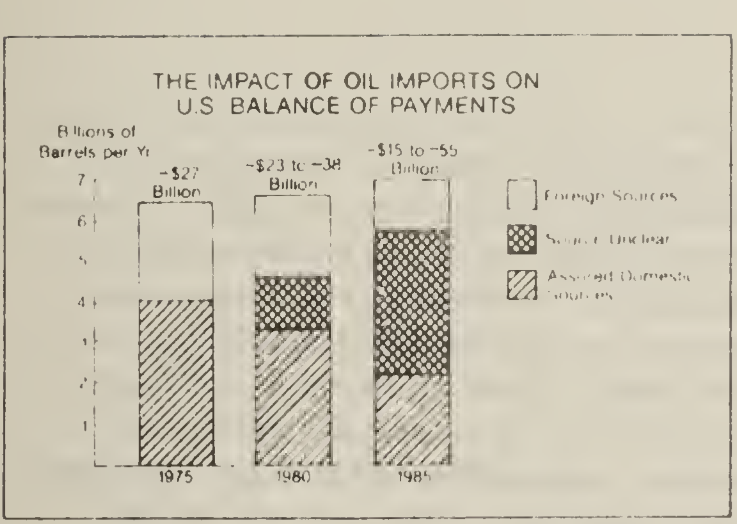
This imbalance between our energy use and our energy resource base is causing the depletion of oil and natural gas. If we were able to suddenly increase domestic production and meet our demand internally, all U.S. oil resources would be exhausted by 1990 and natural gas by 1995. If we then relied on coal, it would be gone by the middle of the next century.



But it is highly unlikely that we will increase domestic production. Rather, the Federal Power Commission now estimates that production of natural gas in 1985 will be about 60 percent of 1974 levels.

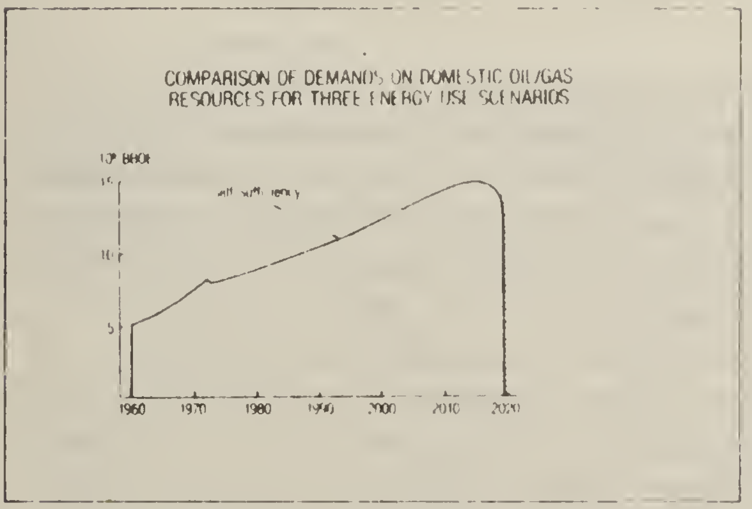
Taking oil and natural gas together, we project that domestic supply of these fuels from all sources--known and unknown reserves, Alaska, and synthetic fuels--will decline to 95 percent of their present value by 1985. Adding what we project as the supply of other domestic energy sources shows a total in 1985 of the equivalent of 13.7 billion barrels of oil. If we assume an unrestrained demand for energy (and based on a Series F population projection), total consumption reaches 19 BBOE with the difference being made up by imports.

The resultant ever-widening gap between the supply and potential demand defines the true magnitude and nature of our energy problem. To close the gap we must either prepare to import more than one-fourth our needs or drastically reduce our use of energy and therefore our standard of living. Neither of these do I find acceptable. But fortunately, there is an alternative--the substitution of the more abundant fuels, coal and uranium, for the ever-scarcer fuels, oil and gas.

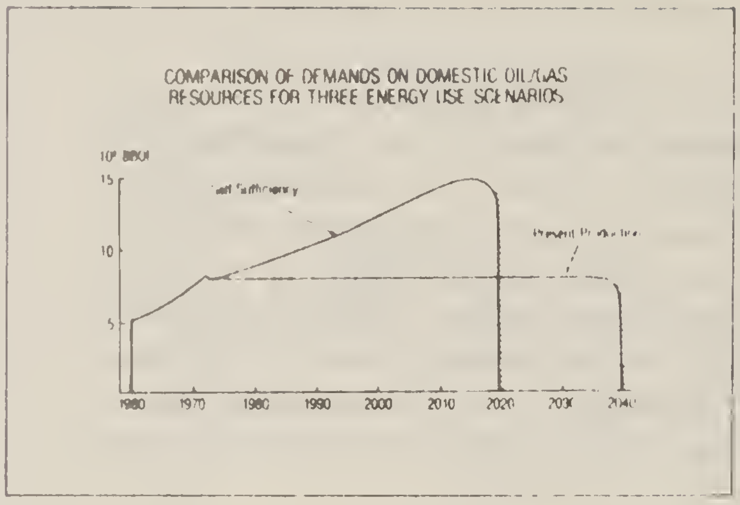


One of the greatest benefits to our society of such substitution is the elimination of our reliance on foreign sources of oil. For if we continue depending on foreign sources, we must import three billion barrels of oil in 1985, assuming maximum domestic production. At today's price of $11 per barrel, the cost would be $33 billion. But by the year 2000, all domestic oil and natural gas should be exhausted. To satisfy domestic demand we would need seven billion barrels of oil and 34 trillion cubic feet of natural gas. At today's prices for oil and LNG, the cost in just 25 years would be $120 billion a year.

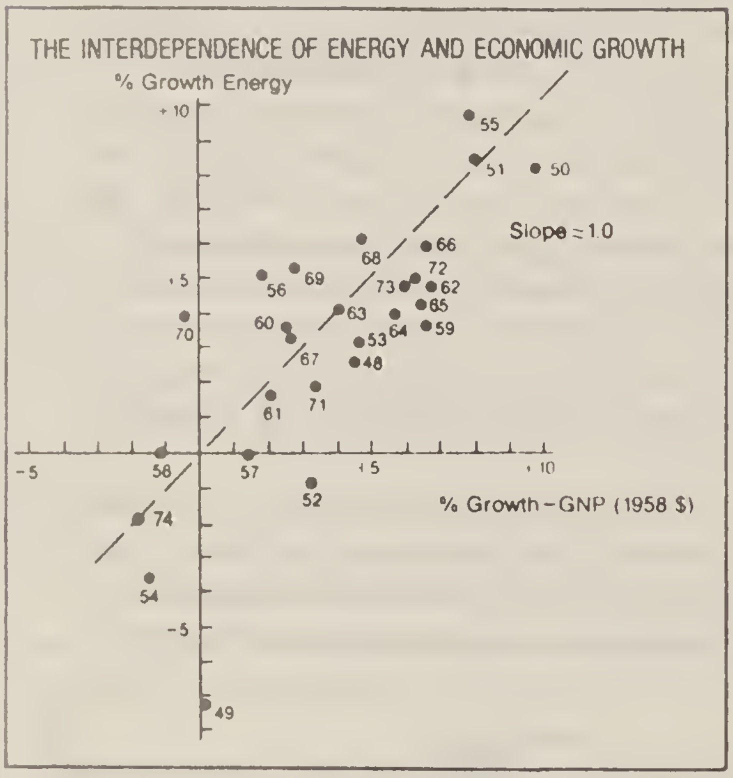
But of course world energy resources will also peak out and production will decline sooner or later. At a four percent growth rate in world oil consumption, total world oil resources would be exhausted by the year 2020.



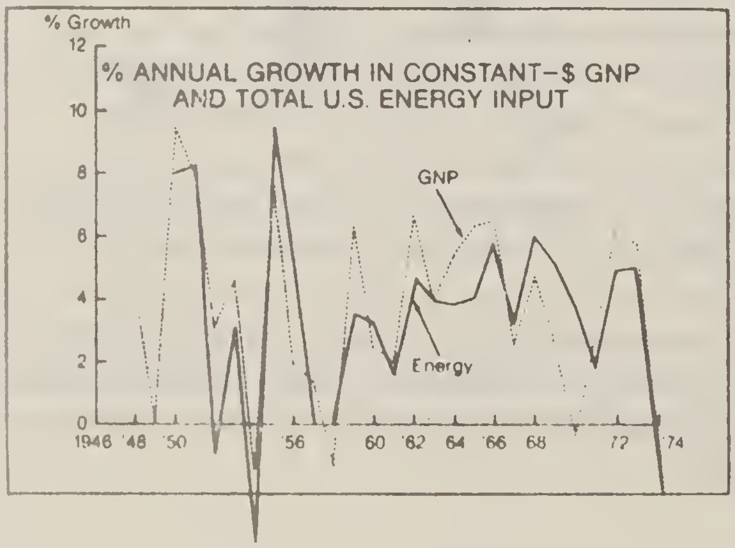
There are many people who believe that if we reduce our growth in energy consumption to an annual rate of 2 percent (compared to the current 4.5 percent), and at the same time step up our exploration and drilling program, our country can be self-sufficient in our energy supply. Even if domestic oil and gas could supply their share of such reduced consumption, which they cannot, that policy would make certain that the United States will be the first nation to run out of its resources of petroleum fuels. Based on the consensus of projected oil and gas resources, this self-sufficiency approach would completely exhaust domestic resources by the year 2020.



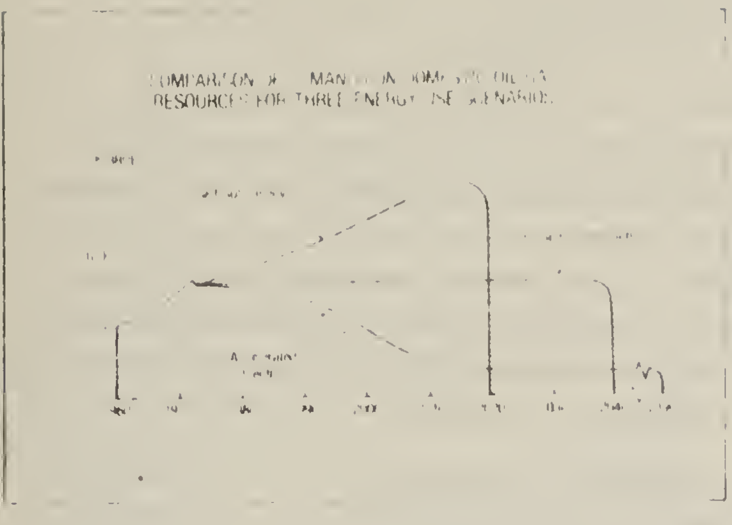
Another scenario for managing the threat of oil and gas depletion which has been advanced by many commentators and students of the problem is the reduction in growth rate of energy use to zero. Its net effect is to extend the depletion date by only about 20 years, to 2040, while having a potentially disastrous effect on our economy.



The proponents of "zero growth" would have us believe that economic growth can continue as energy use is curtailed. But the belief that we can uncouple economic growth from growth in energy use has absolutely no basis in historical fact. Economic growth and energy growth over the past two decades have tracked in almost perfect lock-step. Plots of annual growth rates show a high correlation with essentially one-to-one slope. That energy consumption and standard of living are inexorably tied together is true not only for the United States but for the other nations of the world.



Some feel that the tight coupling between energy and the economy has changed in the United States since the oil embargo, due to higher energy prices. But energy and economic growth rates for the first nine months of 1974 precisely follow the historical trend. Total energy use is down one percent from 1973, precisely the same as the drop in the gross national product in constant dollars. Thus, despite an increase of 70 percent in energy prices, it is very difficult to verify any demonstrated price elasticity in total energy--the full decline in energy use can be entirely accounted for by depressed economic growth.



A third energy scenario is the one Westinghouse has been advocating for the last two years--the shift to an energy base which relies on coal and uranium, most of which would be used in the secondary form of electricity.

Historically, nations have shifted their energy base with relative ease. Man has moved from wood to coal to oil as his primary energy fuel within two centuries. Now, however, we are consuming such great quantities of energy so quickly that any shift in the primary energy base must begin well before depletion begins. The development and deployment of new energy sources requires several decades at least. Once a new energy source reaches commercial acceptance, an economic infrastructure and industrial base must be built up before any meaningful level of consumption can be reached.

In assuming a coal/nuclear energy base, you may feel I am overlooking some of the other energy sources that recently have received wide publicity. And to a great degree I am, because they do not seem to offer much hope. This can be demonstrated by examining our world's future energy requirements versus the availability of these other sources. For example, in the year 2000 the world is expected to consume the equivalent of 175 billion barrels of oil. Of that, power generated by the wind, tides and ocean currents could supply only 10 percent between them, assuming such unlikely events as damming all of the bays and port facilities in the world. And the environmental effects of harnessing these forces of nature have not been seriously considered.

NEW ENERGY SOURCES OF THE WORLD YET TO BE TAPPED
(Billion Barrels Oil Equivalent)

Non-Depletable (Per-Year Basis)	
Geothermal Energy	1.55
Wind Energy	5
Tidal Energy	16
Solar Energy	900,000

(World Energy Consumption Rate in 2000 = 175 BBOE)

Geothermal power can provide the equivalent of only 1.6 billion barrels while creating almost as much corrosion and pollution as electricity.

Although solar power can be utilized to augment home heating systems, the economies and practicality are against widespread use of solar power today. As for supplying bulk power, solar energy is too expensive and impractical. Assuming the development of a low-cost collector, solar power generating stations would cost in the neighborhood of $5,000 per installed kilowatt of capacity, which translates into power costs of 30 cents per kilowatthour--in locations where it is feasible. This compares with average rates today of only 3 cents per kilowatthour.

The only practical and available resources whose use can be expanded on the scale required are coal and uranium. The technological and industrial base exists to greatly expand the use of electricity generated by coal and uranium. If we are to shift our energy base away from heavy dependence upon oil and natural gas, it must be to uranium and coal in the form of electricity. Nothing else is there, or in sight.

MAJOR WORLD ENERGY RESOURCES

(Trillion Barrels Oil Equivalent)

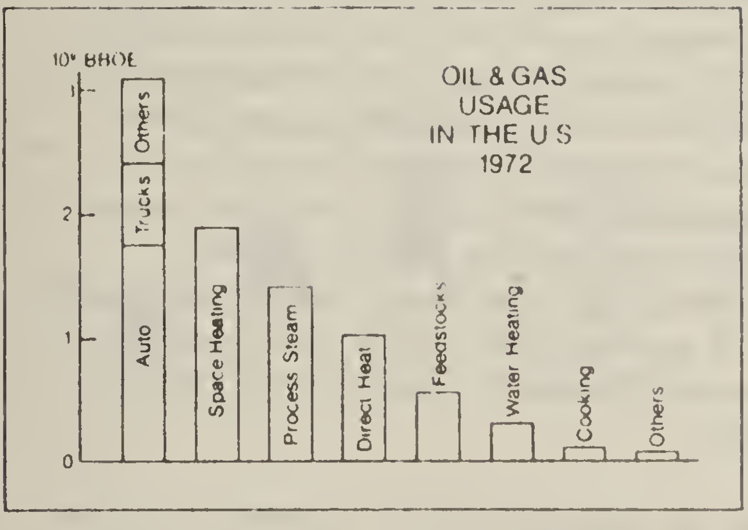
Coal	29
Oil	6
Gas	1.7
Uranium (Fission)	12
Breeder Reactor	72,000
Fusion	1,700,000,000

Coal exists in abundance. Although there are environmental limitations to the full use of coal, and though it is not competitive with nuclear energy, coal use must be greatly expanded. Uranium resources are estimated to be between 2.5 and 3.5 million tons of relatively high-grade ore--the equivalent of 12 trillion barrels of oil--sufficient to fuel light water nuclear reactors into the next century. And by using fast breeder reactors, the efficiency of uranium utilization is expanded by a factor of 60. But because the breeder is so insensitive to cost of fuel, uranium can be used costing as much as $1,000 per pound of U_3O_8. The combined effect means that the breeder offers 6,000 times the energy potential of fission plants.

The breeder reactor is a system that, while producing electricity, generates more fuel than it consumes. The breeder converts zero-value by-products of the light water reactor--depleted uranium tailings from enrichment plants--into fuel for future plants. Using existing uranium tailings, the liquid metal fast breeder reactor itself would require no mining or land disturbance for at least 100 years.

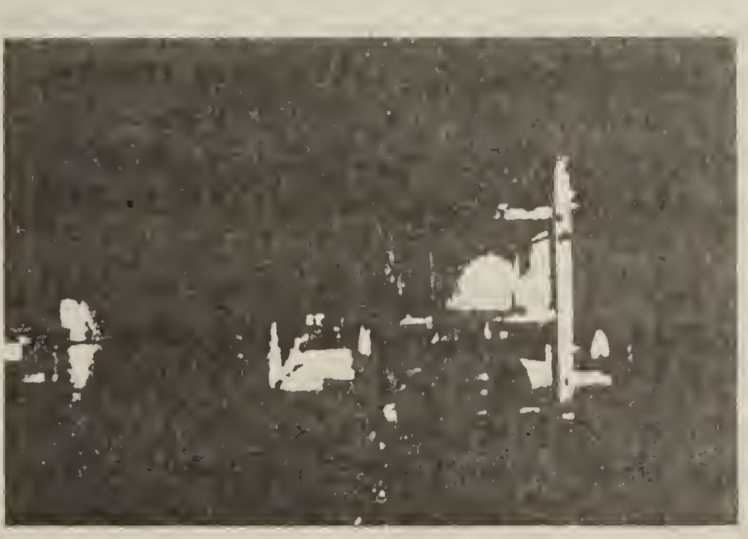
Thus, nuclear is an energy source sufficient to meet expanding energy demands for several centuries to come. This fact has not escaped the other industrialized nations. During 1974, France, Germany and Spain moved to the top three positions among the 32 countries, excluding the United States, committed to the use of nuclear power. These three nations have made commitments for 118 reactors which will generate 100,000 megawatts of power. Commitments for these and all other countries (exclusive of the United States) now total 348 reactors in operation, under construction or planned, for a total of 220,000 megawatts.

In addition to being a proven and available technology, nuclear energy is today the most inexpensive means of generating electric power. The electricity generated by nuclear plants today costs approximately 40 percent less including capital allocations, than fossil fuel plants. A kilowatthour of electricity now costs an average of 10.5 mills when produced by a nuclear plant compared with 17.3 mills for fossil plants. Nuclear plants have a higher front-end cost but the nuclear fuel costs are so much lower that the total cost of generating electricity is substantially less than oil- or coal-fired generating plants. During 1974, fossil-fuel power costs rose approximately 85 percent while nuclear fuel costs remained steady or actually declined. Fossil fuels, on average, now cost 11.6 mills per kilowatthour, nearly six times as much as nuclear fuel at 2 mills. Nuclear should easily maintain its competitive margin over coal even in the face of much higher uranium costs in the future.



But just generating electricity is only half the answer. To effect a shift in our energy base to more abundant fuels, we must substitute electricity for the direct combustion of oil and natural gas wherever feasible. This requires that the products and devices which actually use electricity be developed, marketed and used where they can do the most good.

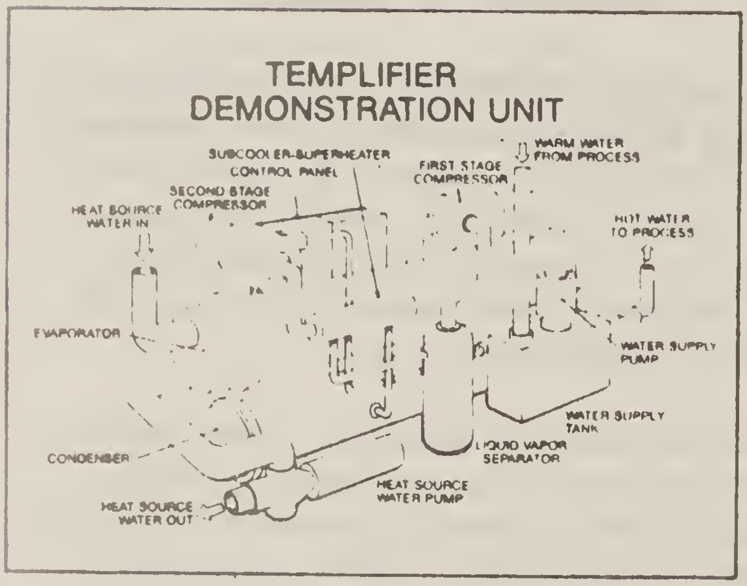
Examining the use of oil and gas in the United States, we find that transportation, space heating, process steam and direct heat in industry constitute 80 percent of our total use of oil and gas. These are the areas where the greatest savings can be effected.



For industrial direct heat applications, factories can use more electric resistance, induction and dielectric furnaces and ovens for direct heat in a number of processes. They are clean and efficient and often provide economy and a higher quality end product. A typical example of what can be done is in our Lamp Plant in Salina, Kansas. Faced with the need for additional glass melting furnace capacity and an inability to contract for natural gas, we're now installing an electric furnace alongside the original gas furnace.

In both the residential and commercial sectors, electric space heating is already well known and growing in use, but it is primarily of the resistance type. Lesser known and accepted is the electric heat pump. Taking most of its energy from the outside environment, the heat pump has more than four times the efficiency of an oil or gas furnace and should become the major means of heating and cooling. It is now economically competitive over most of the nation.

The heat pump did have its problems when first introduced, but today thoroughly reliable units are available. With the proper marketing effort, the heat pump should gain acceptance in most areas of the country. We believe it will be possible to have 28 million homes heated electrically by the year 1985, 12 million with the heat pump.

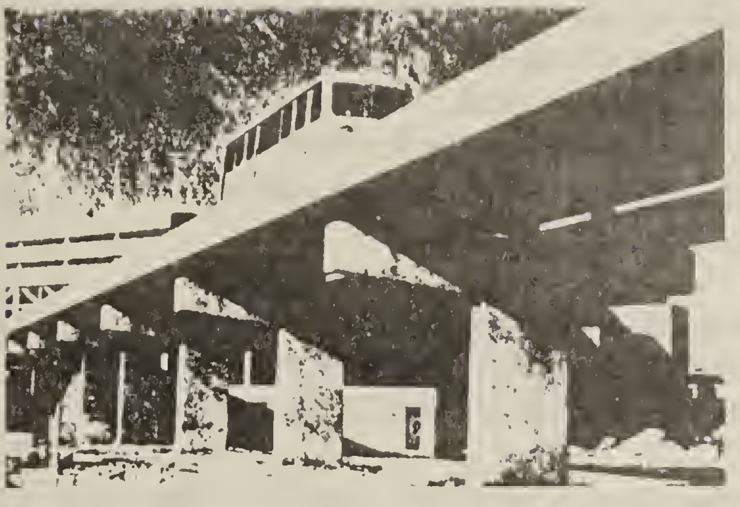


Industrial process steam is the largest single user of energy in the economy, accounting for one-sixth of the total. Greater use of coal and electric boilers can significantly reduce gas and oil consumption for process steam, but we are developing a new device for this application which we call a "Templifier" -- short for temperature amplifier. It functions essentially like a heat pump and can provide steam at temperatures which will meet many industrial requirements, using 35 percent less energy than a fossil-fired boiler, even allowing for losses in production and distribution.

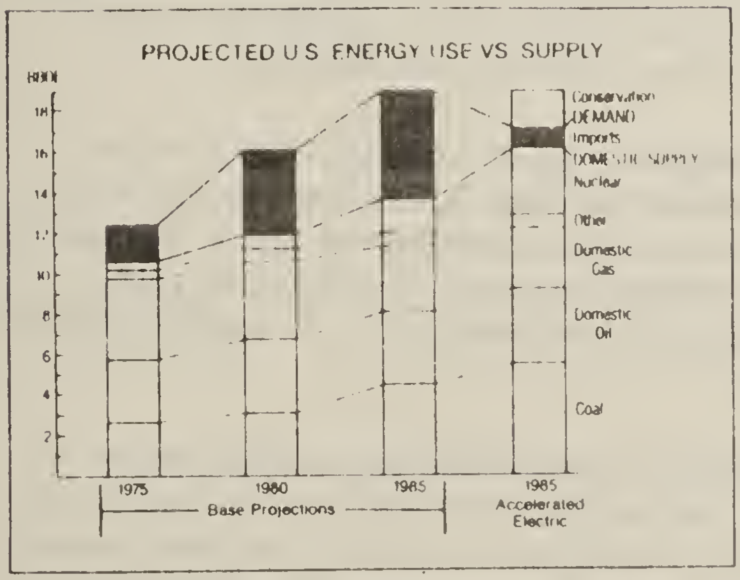
Transportation consumed nearly 60 percent of our oil last year. Twenty million dollars a year is being spent throughout the world on battery research and we shortly should see new batteries with double the performance of present-day lead-acid types. By 1985 we see batteries with four times the performance of lead-acid, and before the end of the century that figure will be 10.

For some time now we have been experimenting with battery-powered vehicles designed for light delivery service. Included in the test program has been their operation over actual residential mail delivery routes. During test runs these vehicles use 12 kilowatthours or about 30 percent (at 10,500 BTU/kWh) of the energy in the three gallons of gasoline used by the regular post office van of the same size.

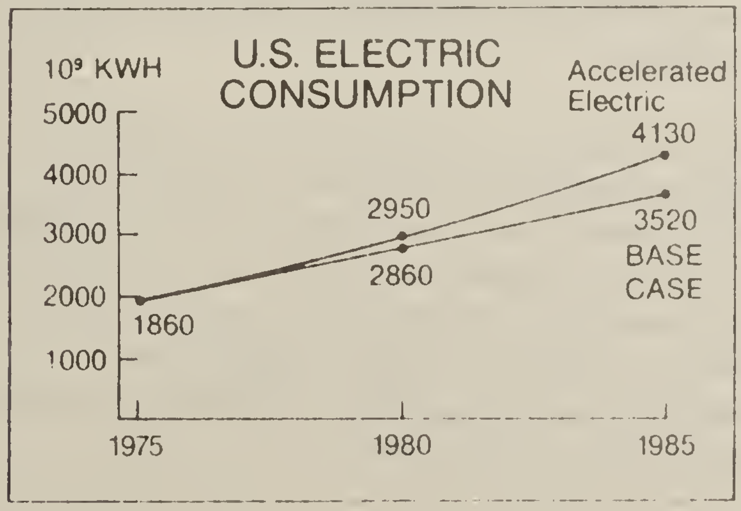
We expect that the electric vehicle will find initial acceptance and use as a light van for urban service in fleet-type operations such as mail and parcel delivery, appliance servicing, taxis, and utility meter reading and maintenance. It would be possible to have 5 million electric vehicles of all types in operation by 1985 and 100 million by the year 2000.



Electrified trains could capture half of the intracity freight from trucks and 10 percent of the passenger traffic from airplanes. Electrified rapid transit could take millions of commuters out of automobiles.



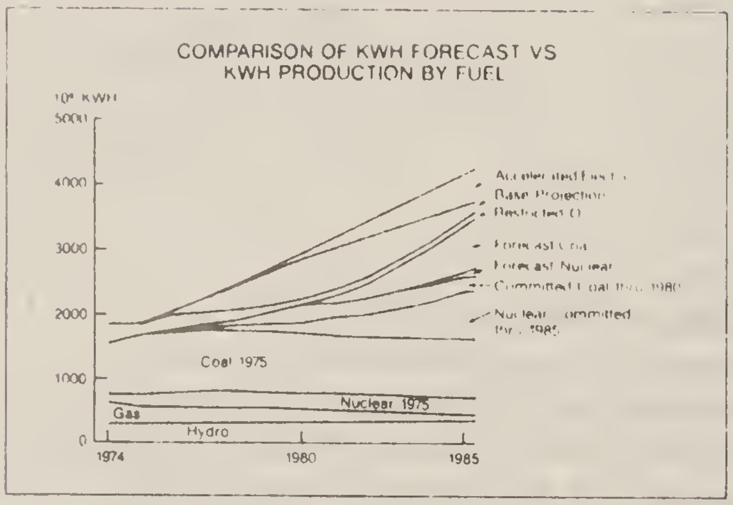
The substitutions we have identified could save 2.2 billion barrels of oil equivalent in 1985. Coupled with stringent conservation practices and the direct substitution of coal in many industrial applications, the need for imports of oil and gas is reduced to a manageable level of 1.3 billion barrels of oil equivalent or 3.6 million barrels per day.



Now let's examine what all this means in terms of requirements for new electric generating capacity. Here is what we call the "base case" -- which is the current conventional projection of electric consumption, assuming that there is no shortage of fossil fuels. This base case puts total consumption at 3520 billion kilowatthours by 1985. But to take care of all the substitutions we have discussed, total consumption should rise to 4130 billion kilowatthours after allowing for conservation--an increase of 17 percent over the conventional projection.

On the surface that would appear to be an attainable goal. However, the trend right now is in the opposite direction. Electric utilities have recently cancelled or delayed almost 200,000 megawatts of generating equipment. That is over one-half the backlog of this equipment or enough to substitute for 1.5 billion barrels of oil per year in 1985. Also detrimental to an accelerated use of electricity is the President's program restricting the use of oil by utilities to 80 million barrels a year by 1980.

With this combination of facilities delay and fuel allocation, it does not appear that utilities will be able to meet the increased demand until 1990 or later.



Here is our projection of electric supply by type of fuel. It is our most optimistic one based on what is believed to be a maximum of coal and uranium mining, a maximum of rail transportation available, and no further delays in generating plant additions.

In 1985, the supply is seen to fall short of even the currently projected demand, much less the increase required for the electric substitutions we've discussed. But the most critical shortfall is in the year 1980, simply because the time available to do anything about it is so short.

The seriousness of this impending shortfall cannot be overstated. For in the years from 1977 to 1980 as our economy is struggling to recover from the current recession, we will not have enough electricity to help foster that recovery.

There is only one hope for averting such a situation. The generating equipment that has been delayed over the last several months must be returned to its original schedule. (I say this despite the truism in the manufacturing fraternity which holds that an order once delayed cannot be reinstated on the original time schedule.) Second, some part of the original schedule for 1981 must be pulled into 1980.

This same type of acceleration must be seen in coal mining and in the reconstruction of railroads.

Beyond 1980, to this acceleration can be added the effect of shortening the cycle time through more logical siting and licensing procedures.

Lastly, by 1985 it will be possible to effect a significant easing of the new facilities problem through an increase in the utilities' load factor by promoting greater use of electricity during off-peak hours. We presently have a contract from the Federal Energy Administration to evaluate those uses of electricity that can best be controlled, what each would cost the consumer and save the utility, and an appropriate rate structure or other incentives to stimulate its use.

The technology is available to substitute electricity for oil and natural gas in a great many end-use applications. What is lacking now is the climate, the understanding, a national policy, and the products to move toward an electric energy base.

It is a three-pronged problem as I see it. The consumers--industries, businesses, the public--must be made aware that electric energy can and must be used in place of oil and gas in homes and factories.

The manufacturers of products that use electricity must be convinced that the market is there for heat pumps, electric furnaces, battery-powered vehicles, and they must invest the money to develop and market these products.

And then the electric utilities, the Federal Government and the regulatory agencies must have the vision to see the shift to electric energy coming, so that adequate electric generating capacity can be in place when needed. Incentives and encouragement are imperative to shift the nation toward an electric energy base to reduce dependence upon oil and gas. The Government must create the proper climate for this shift, and with respect to some specifics, it must mandate the shift. The natural forces of the marketplace may simply take too long in the face of mounting balance of trade deficits for imported oil and the impending depletion of domestic oil and natural gas resources.

Nuclear generating capacity can be expanded and brought on line in time to accommodate a timely shift to an electric energy base. There are no technological or resource limitations blocking a rapid expansion of nuclear generating capacity. There are, however, a number of institutional problems which must be solved before nuclear energy can play a major role in meeting energy needs.

Power plant lead times can and must be shortened to six or seven years from date of decision to operation. The nuclear fuel cycle must be brought into balance by expanding enrichment and reprocessing capacity and recycling the plutonium generated during the operation of light water reactors. The liquid metal fast breeder reactor must remain the nation's top-priority energy research and development effort, and a commercial breeder industry must be formed in the late 1980's.

In all of these areas, the Government is the key to the solution, as the nuclear industry can only move as fast as the licensing and regulatory authorities will allow.

Manufacturing capacity for power plant equipment can easily be doubled within four or five years as was demonstrated in the late 1960's.

However, this is all academic in the light of the electric utility industry's crippled financial condition. Soaring costs, stagnant revenues, and the need to raise from external sources more than $10 billion annually for construction have driven the utilities to widespread deferrals and cancellations of generating capacity, most of which is nuclear. This penalizes both the industry and the consuming public as each large nuclear plant represents an annual potential fuel saving of at least $50 million when compared with a coal plant and at least $100 million compared with oil.

In the years ahead, the utility industry must raise massive amounts of capital--hundreds of billions of dollars--and 80 percent of this cash must be generated by external financing. This cannot happen if stock prices remain depressed below book value and bond interest rates continue at very high levels.

While some rate relief and rate adjustments based on higher fuel cost pass-throughs have stemmed what could have been a precipitous decline in utility earnings, the investment community has not regained its confidence in the electric utility industry and its prospects.

Let me suggest what the Administration could do to initiate a shift to an electric energy base and put the utility industry on a sound financial footing so that the shift can take place.

First, both the Administration and the Congress must realize that the use of more electricity generated by abundant fuels can let us reduce dependence upon dwindling oil and gas resources and on foreign supplies. This proposition must be explicitly stated as part of a national policy on energy. Simply agreeing and stating that a move to an electric energy base is essential would go far toward getting the ball rolling.

Then, the regulatory commissions and other state agencies who wield control over the utility industry must grant the needed financial relief so the industry can once again become geared for growth and expansion. I must point out that many of the utility activist movements masquerading under the banner of consumerism are crusading for ultimate goals that are not in the best interest of the consuming public.

Thirdly, actions that many would label subsidies must occur:

- Increasing the investment tax credit from 4 to 12 percent
- Allowing construction work in progress to be included in the utility rate base
- Allowing utilities to issue tax-free securities
- The elimination of various local taxes and levies on utility sales
- Expeditious handling of rate cases.

Having identified a national energy policy which has as its central strategy the use of more electricity generated by coal and nuclear energy in place of oil and gas where feasible, the Government could take further steps to make substitution come about:

- Phase out the use of gas and oil for base load generation by mandate
- Recommend rate structures that encourage the use of electricity in lieu of oil and gas
- Prohibit the use of gas and oil for heating in new residential construction and allow gas or oil furnaces in replacement on a special permit basis only
- Remove restrictions on the promotion of electricity
- Establish Federal minimum standards for heat pumps
- Provide tax incentives that minimize the use of energy and maximize the use of electricity in new buildings
- Mandate that all new Federal facilities use electricity for heating and cooling.

In the transportation sector, the Government should take the lead by using electric vehicles in urban areas, and subsidies for mass transit systems should be increased to lower the price of commuting.

Special taxes on the use of gas and oil for industrial needs should be levied where substitution of electricity is possible and feasible.

Our basic problem is essentially a shortage of oil and natural gas. We are simply running out. The only feasible way to approach this problem is to shift our energy base and make the greatest use of what we have the most of--uranium and coal. The Government, its various energy agencies and organizations, industry and the public have not recognized this fact. Shifting to coal and uranium means moving to an electric energy economy, and to do this we must begin immediately using electricity wherever possible in place of oil and gas, which must be jealously hoarded in order to conserve them as long as possible for essential uses.

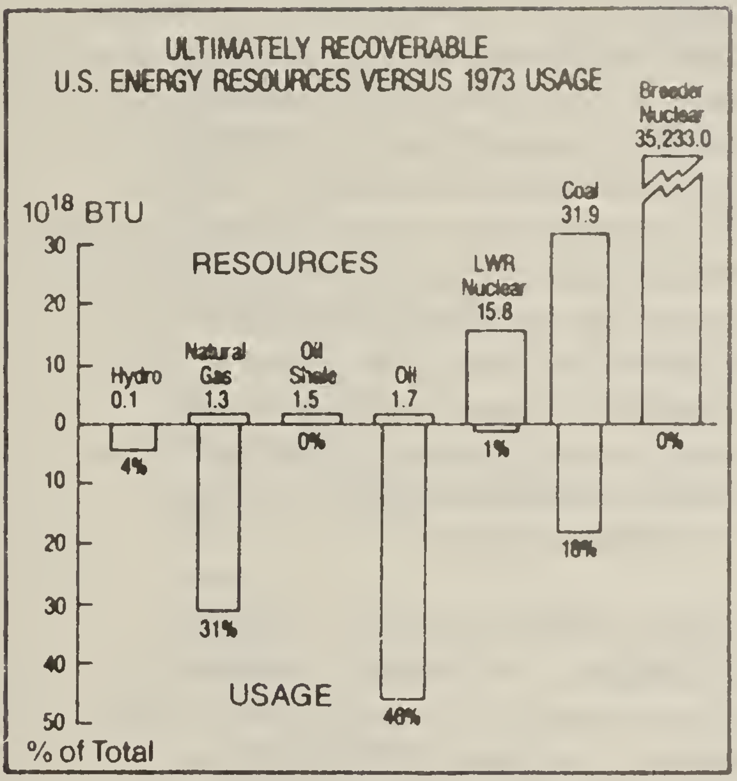
Steps must be taken to encourage the development and use of devices that utilize electricity rather than gas or oil, and the roadblocks inhibiting the timely expansion of electric generating capacity must be removed.

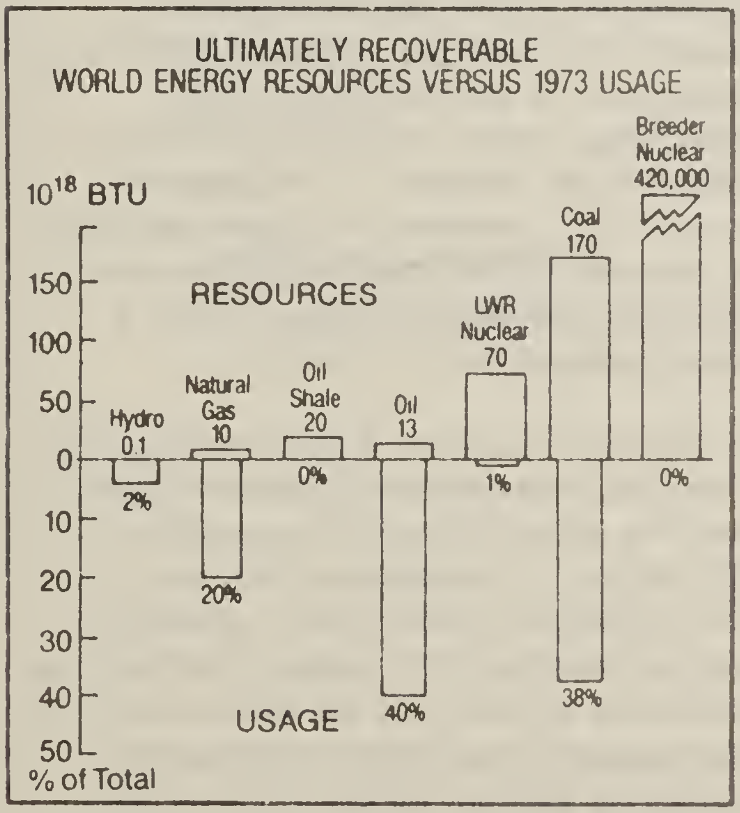
The economy cannot possibly adjust quickly enough to bring about these changes in a timely fashion and without severe economic and social dislocations. Thus, the Government must take the lead in shifting our energy base before our energy problems become more severe and cause massive injury to the nation's economy.

APPENDICES

Appendix - A

RESOURCE BASE





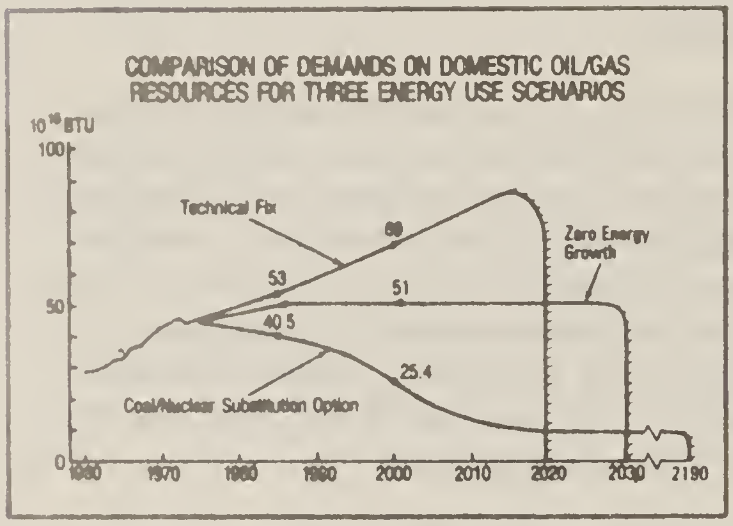
Energy Resources

The crux of both the U.S. and world energy problem lies with an over-reliance on our most scarce energy resources. A policy of major reliance on oil and gas, if continued until the time of near depletion, will produce a disastrous situation once the production of these vital fuels begins to decline sharply. A period of several decades will be required to effect an orderly transition away from reliance on oil and gas, and that transition should be underway now.

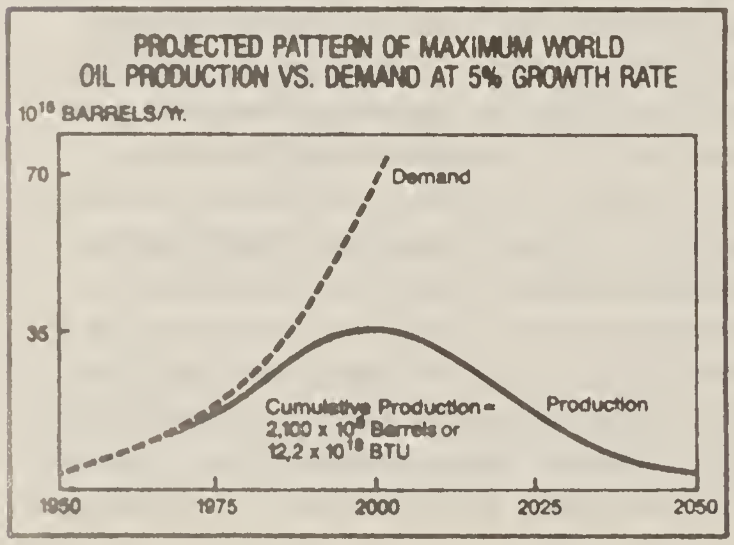
A comparison of the nation's ultimately recoverable resource base with our present pattern of consumption makes the root of our energy problem dramatically clear. M. King Hubbert of the U.S. Geological Survey has done some excellent work on quantifying energy supplies on this ultimate base. Using his figures for fossil fuels, and AEC data on uranium, gives this picture of the world and U.S. ultimate supplies of our present primary energy sources. The energy shown as available from U_{235} is based on using present water reactors of the non-breeder type with plutonium recycle, and includes uranium reserves with costs up to \$100 per pound of U_3O_8 . . We will see later that the breeder reactor will multiply the potential energy from uranium by 1500. Please note especially how little of this energy reserve supply is in the form of oil and gas.

When we compare this supply pattern with the present usage rates of each of these fuels, we see how out of proportion the use of natural gas and oil is with their available supply. Natural gas accounts for only 1.5 percent of the U.S. supply, but 32 percent of our use. Likewise, oil accounts for only a little over 2 percent of the supply, but 44 percent of the demand. Coal, on the other hand, accounts for 63 percent of the supply, but only 22 percent of the demand. Similar disparities are evident in the world picture. It doesn't take much imagination to see what energy sources are in serious trouble and why.

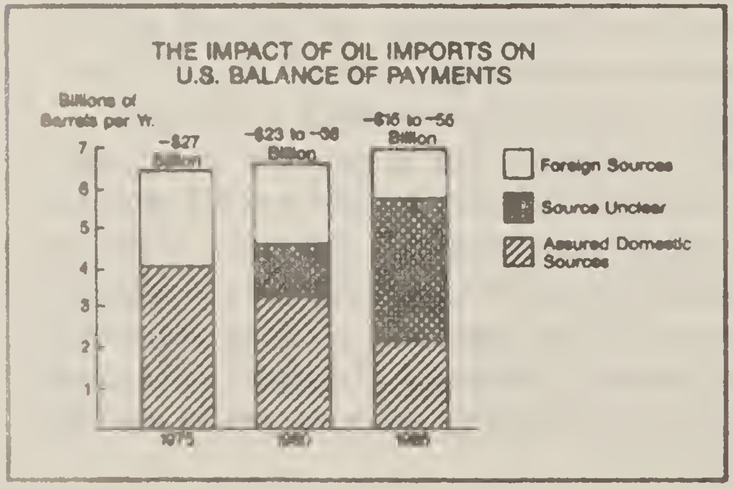
Quantifying the Depletion of Oil and Natural Gas



The Energy Policy Project of the Ford Foundation postulated two patterns of possible energy consumption for the United States. The "technical fix" scenario was to use existing technology to the maximum practical extent to decrease future energy requirements; the "zero energy growth" scenario was to further reduce energy usage to a zero growth condition. In both instances, these severely restrictive cases exaggerate the possible level of domestic production, and cause all domestic oil and gas to be both discovered and depleted shortly after the turn of the century. The coal/nuclear substitution case, which was not considered in their report, allows oil and gas to be available for critical non-substitutable end uses until the end of the 22nd century.



The world oil usage situation leaves no hope of alleviating this problem. Oil usage in the rest of the world is growing even faster than in the United States. In addition, it is clear that the cycle of world oil production will cause that production to peak near the end of this century. Thus at the time that U.S. domestic oil and gas production are precipitously declining, world production will begin to cease growing and also decline. It will then be impossible for world oil production to fully meet the increased U.S. demand without restricting severely oil shipments to other consuming nations. Such a situation is clearly untenable.



Present world oil prices are over $11.00 per barrel, and using the Project Independence blueprint's Base Case projection, the deficit balance of payments in 1975 will be $27 billion. The blueprint foresees increasing U.S. production in the future, allowing imports to drop, so that the deficit slips to $23 billion in 1980 and $15 billion in 1985. In the much more likely event that domestic production continues to decline, and assuming that the added deficit is also filled with imports, the deficit in 1980 could be as high as $38 billion, and as high as $55 billion in 1985.

REMAINING U.S. FUEL RESOURCES

(In 10^{18} BTU)

	Oil[a, b]		Gas[a, b]		Oil Shale[a, b, d]		Coal[a, b]		Conv. Nuc. Using U235		Breeder Reactor Using U238 - U239	
	Recoverable	In Place	Recoverable	In Place	Recoverable	In Place	Recoverable	In Place	Recoverable	In Place	Recoverable	In Place
Schweinfurth (U.S.G.S.)[1]	-	19 7										
Zapps, Hendricks (U.S.G.S.)[1]	3.00	17.1	2.42	6.89								
Weeks	2.07	7.07	0.63	0.89								
Elliott & Linden (U.S G.S)[1]	2.01	6.90	1 39	1.84								
Moore (U.S.G.S.)[1]	1.93	3.30	1.19	1 59								
Miller (N.P.C.)[1]	1.18	4.56	-	-								
Ryman (Exxon)[4]	1.17	·	-	-								
Hubbert (U.S.G.S.)[1]	0.73	3.24	0.83	1.61								
Potential Gas Committee (Colorado School of Mines)	-	-	1.52	1.99								
Duncan, Swanson (U.S.G.S.)[2]												
25 Gal./Ton & Over					-	7.7						
10 Gal./Ton & Over					-	161						
Averitt (U.S.G.S.)[1, 4]							31.9	64.6				
Westernstrom (U.S.B.M.)[3]							19.5	38.9				
Nininger (AEC)[5]												
\$/lb. U_3O_8												
up to \$10									.97		67.9	
up to \$30									2.19		153 3	
up to \$50									7.65		535.5	
up to \$100									15.83		1,106.1	
up to \$200 (land only)									503.3		35,233	
up to \$200 (land + 10% of ocean)									604	604	42,280	42,280
Finch, et.al. (U.S.G.A.)[2, c]									20.2		1,415	
Average of Responsible Opinions	1 7		1.3		Note e		Note e		Note e		Note e	
☞ Most Likely Estimate	1.0		0.8		1.5		31.9		15.83	-	35,233	

REFERENCES:

1. Geological Survey Circular 650.
2. Geological Survey Professional Paper 820.
3. Minerals Yearbook Vol. 1
4. Scientific American, September 1971.
5. "Nuclear Resources", a paper presented at the Energy Resource Conference, University of Kentucky, Lexington, May 11, 1971.

FOOTNOTES:

[a] Conversion Factors Assumed:

1 barrel crude oil	= 5.85×10^6 BTU
1 cubic ft. natural gas	= 1,032 BTU
1 metric ton of coal	= 22×10^6 BTU
1 metric ton U_3O_8	= 1×10^{12} BTU in conventional reactors = 70×10^{12} BTU in breeder reactors

[b] Excludes cumulative production to date as follows:

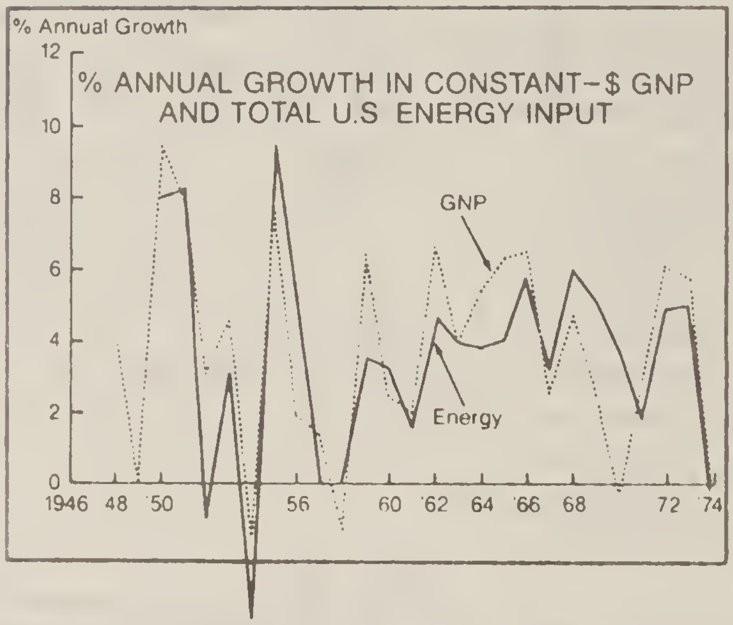
Oil	= 0.6×10^{18} BTU
Gas	= 0.4×10^{18} BTU
Coal	= 0.8×10^{18} BTU
Uranium	= 0.002×10^{18} BTU

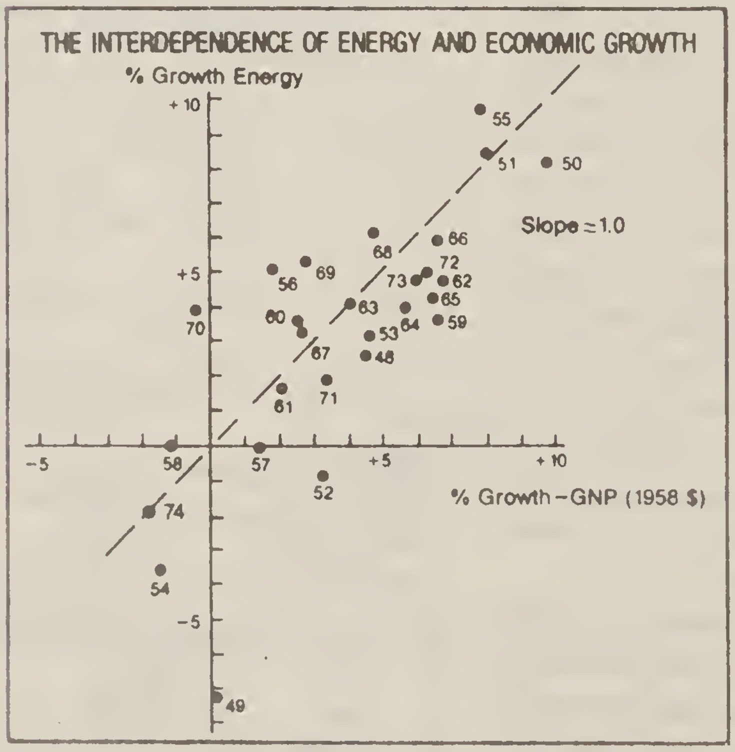
[c] Includes no speculative or unknown marginal reserves; only known recoverable reserves and known paramarginal reserves.

[d] U.S. has virtually no tar sands.

[e] Insufficient sample size to average.

ENERGY VS. GROSS NATIONAL PRODUCT

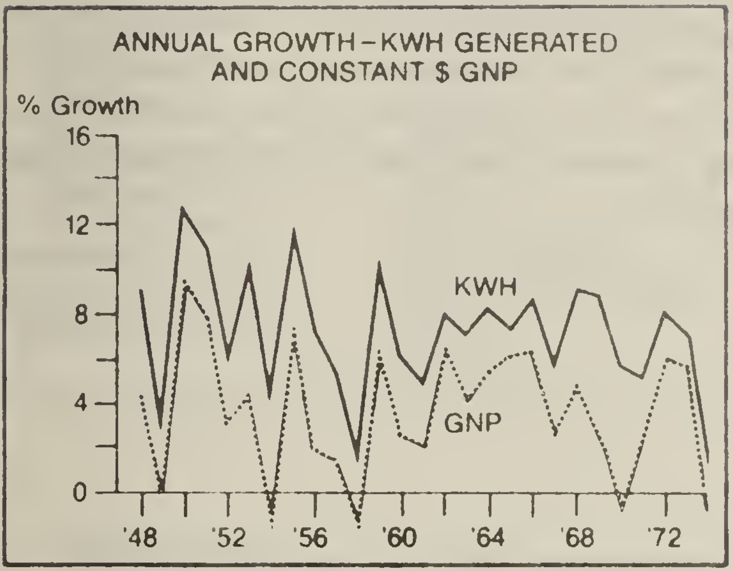


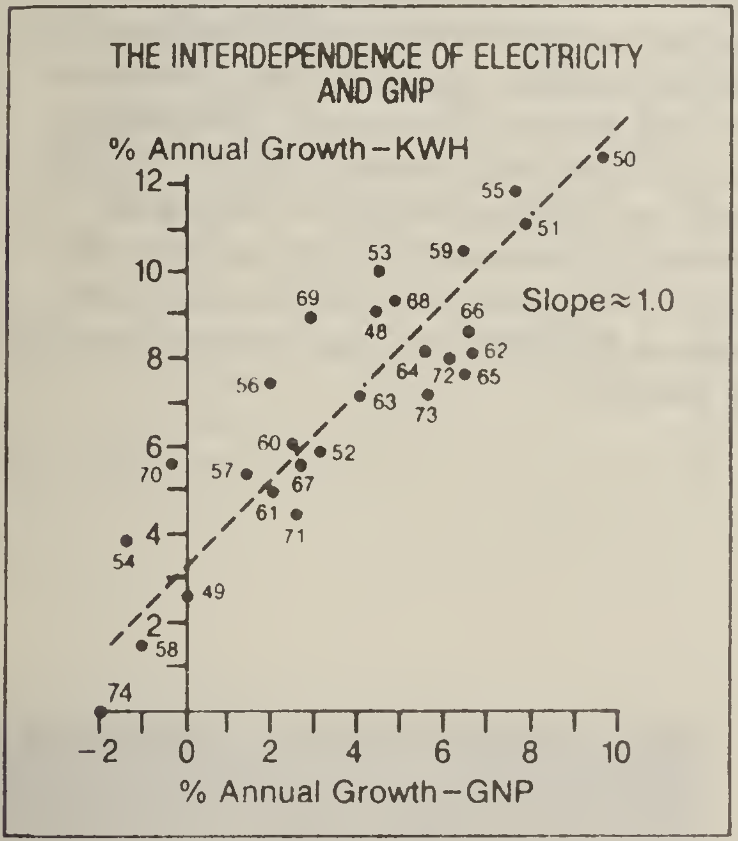


The Relationship Between Energy Usage and Economic Growth

Many proposals are heard today which assert that there is no relationship between the use of energy and the growth of economic prosperity. In fact, however, history shows a tight coupling between the two. Even during the chaotic period of 1974, the coupling continued to be apparent.

It is possible to construct a graph using this tight coupling which is of use in predicting future behavior. This graph can be used in two ways. First, if it is believed that the growth in the Gross National Product over the previous year will be about 4%, for example, then the corresponding growth rate in energy usage must also be about 4%. Secondly, if, through a combination of events, such as another oil embargo, restrictions on coal use, a nuclear moratorium or the like, a limit on energy growth is established of, say, 1%, the coupling between energy and GNP growth forces this same limit on GNP growth. It is inescapable that an increasing availability of energy is required for increasing economic prosperity.


ANNUAL GROWTH-KWH GENERATED AND CONSTANT $ GNP

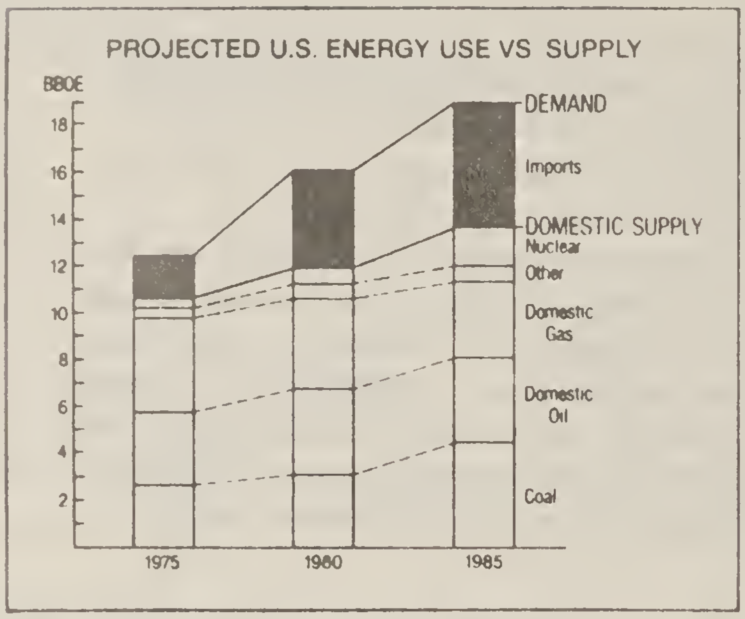

THE INTERDEPENDENCE OF ELECTRICITY AND GNP

The Relationship Between Electricity Usage and Economic Growth

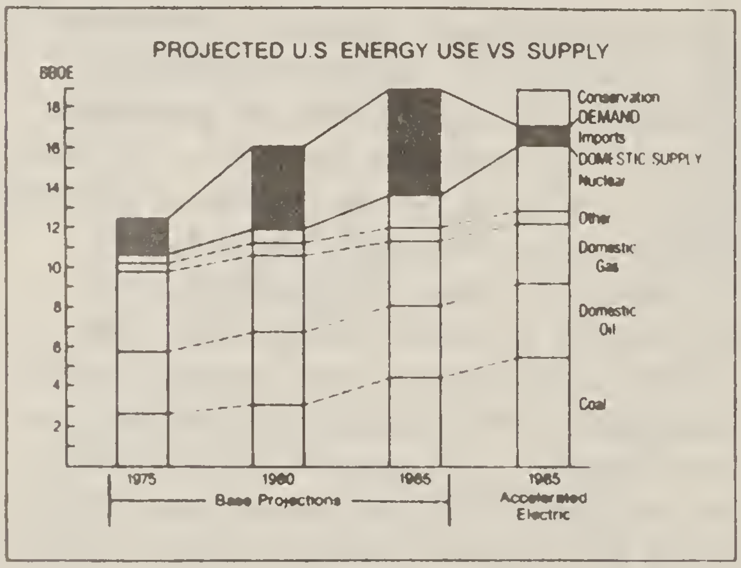
Since electricity is a major form in which energy is consumed, it should be expected that its usage varies with changes in economic growth in much the same manner that total energy does. The two quantities do move together, but in addition, electricity usage growth rather consistently exceeds GNP growth by 3 percent. This is indicative of the convenience of electricity with respect to competing fuels in end-use applications. Eventually, of course, electricity's share of total energy will saturate, and the 3 percent differential will disappear. However, this disappearance will not occur before the 21st century.

Present and proposed legislation places restrictions upon the ability of the electric utility industry to construct and operate the coal and nuclear generating facilities which will be required in the future. In fact, through November, 1974, 49,500 megawatts of committed generation additions were cancelled, and 147,200 megawatts were delayed. Since the inability of the electric utility industry to grow places a limit upon the growth of GNP, and since coal and nuclear energy can largely contribute to the economy only through conversion to electricity, it is imperative that these restrictions be removed or at least greatly modified. A failure to do so would seem to assure a deterioration of the nation's economic well-being.

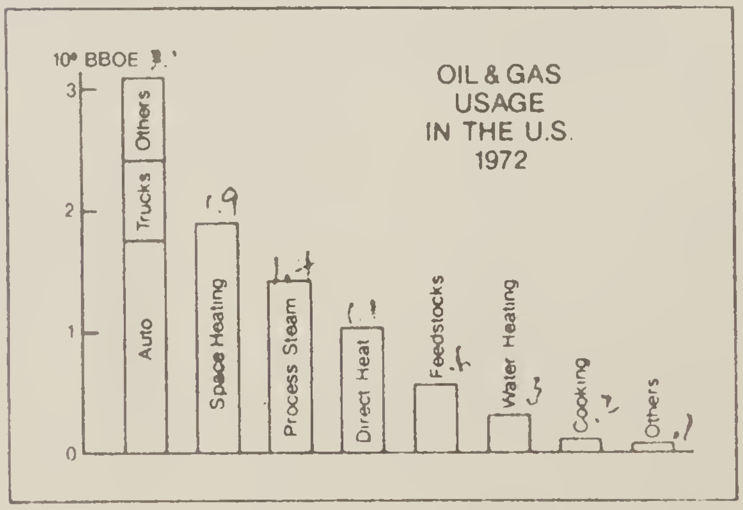
ELECTRIC SUBSTITUTION



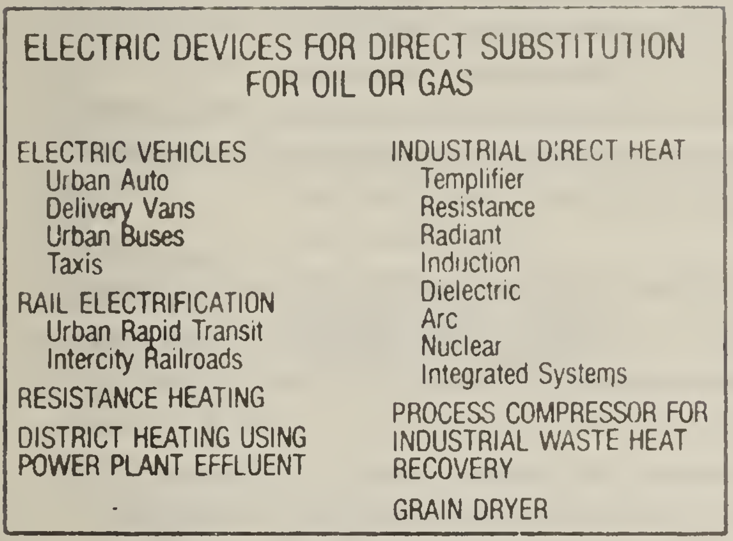
If the consumption of energy were not restrained by either shortages or high cost of fuels, it would rise sharply to the year 1985, as energy is used to feed our economy's recovery from the current recession. To supply such a demand will require an ever increasing level of imports.



Conservation can narrow that gap somewhat without significant degradation of our lifestyle. This would include things like smaller cars, better insulation and more efficient appliances. And coal can be substituted directly for oil and gas in a variety of end uses, particularly in the industrial sector. But we're still left with a large gap between supply and demand. It is that gap which the Electric Energy Economy will fill by substituting domestic coal and uranium in the form of electricity for end uses of oil and gas wherever and whenever possible.



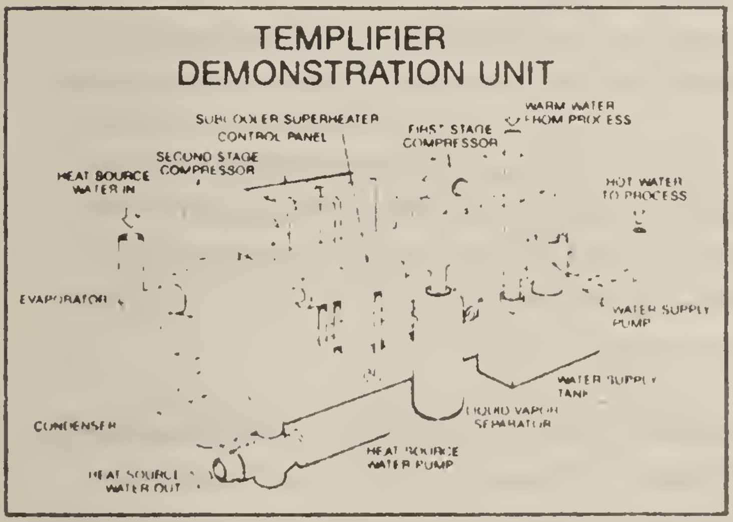
In 1972, oil and gas uses offering the greatest potential for substitution occurred in just four areas. If a significant reduction in the use of these fuels is to be accomplished, electrical substitutes must be available in each of these areas.



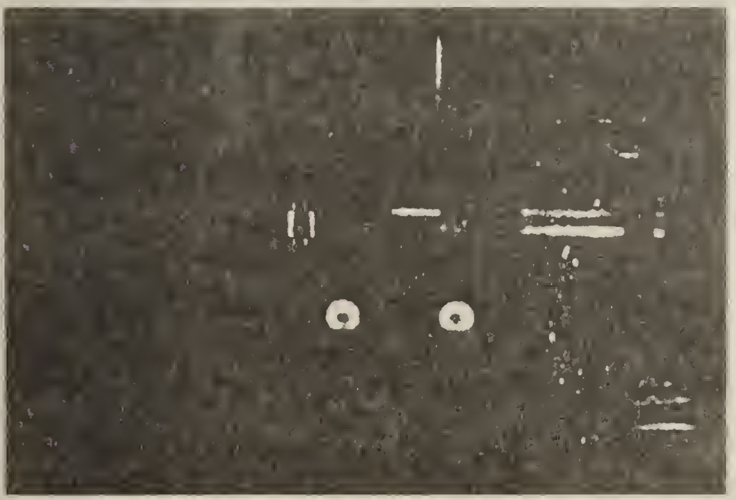
ELECTRIC DEVICES FOR DIRECT SUBSTITUTION FOR OIL OR GAS

- ELECTRIC VEHICLES
  - Urban Auto
  - Delivery Vans
  - Urban Buses
  - Taxis
- RAIL ELECTRIFICATION
  - Urban Rapid Transit
  - Intercity Railroads
- RESISTANCE HEATING
- DISTRICT HEATING USING POWER PLANT EFFLUENT
- INDUSTRIAL DIRECT HEAT
  - Templifier
  - Resistance
  - Radiant
  - Induction
  - Dielectric
  - Arc
  - Nuclear
  - Integrated Systems
- PROCESS COMPRESSOR FOR INDUSTRIAL WASTE HEAT RECOVERY
- GRAIN DRYER

For some uses of oil and gas, electric devices already exist for providing technically and economically feasible substitutions. In other areas, product development or a major research breakthrough are needed. For example, in the industrial sector, the use of process steam accounts for one-sixth of all the energy used in the United States--80 percent of that from oil and gas. Electric boilers can be used (resistance or anode type) but their operating cost is high relative to boilers using fossil fuels. So, electric boilers are seldom used. Westinghouse is now developing an economical method of electrically supplying process steam. It is called the Templifier.


TEMPLIFIER DEMONSTRATION UNIT

The Templifier--short for temperature amplifier--functions much like a heat pump but over a much higher range of pressures and temperatures. Given any large body of water as a heat source, the Templifier pumps heat out of it, thus cooling it perhaps 5 degrees. But that much heat, when pumped into a comparatively small tank of water, will raise its temperature to a level of 250 degrees, or steam. Any body of water will do--a lake, a river, the ocean, or the heated effluent from an electric generating plant. This temperature amplification can be done at an efficiency approaching 300 percent.

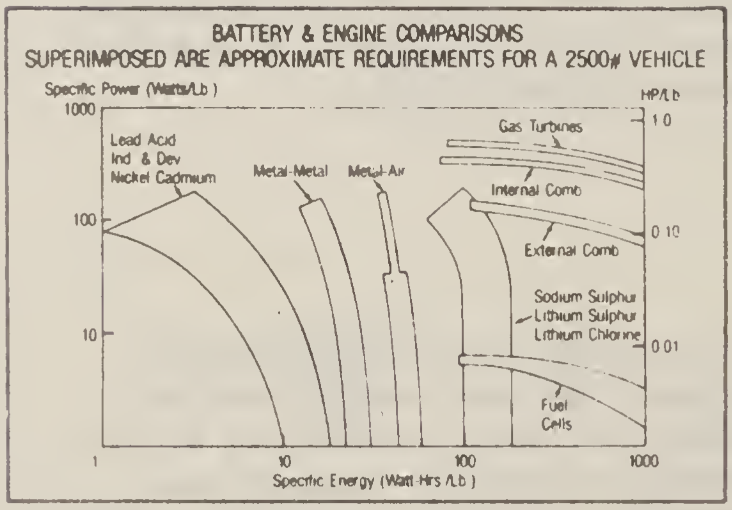


And in the case of using direct heat in industry, electric resistance, induction, radiant, arc and dielectric furnaces and ovens already exist for providing direct heat. A recent development--the alternating-current arc heater--now makes possible the use of electricity where exceptionally high temperatures are required. A gas is passed through the electric arc, heating the gas to 8,000 degrees. The hot gas is then used to apply heat directly or indirectly to the substance being heated.

At the Westinghouse Research Laboratories, three experimental battery-powered vehicles have been in operation for the past year and a half. Two of these vehicles are designed for light delivery service. They are fully licensed and have accumulated nearly 5,000 miles on the road.

Included in our test program has been their operation over actual residential mail delivery routes in the very hilly area near the Laboratories. Starting at the post office in the morning, our vehicle follows a post office van on its regular run. Throughout the day, when they go, we go; and when they stop, we stop. They're loaded with mail; we're loaded with instrumentation. While these vehicles were originally designed as test beds for batteries, they have demonstrated conclusively that battery-powered vehicles are capable of effectively, conveniently, and safely performing missions of this nature.

During such a test run they travel an average of 20 miles, make 318 starts and stops, and use 12 kilowatthours. That is only 11% of the energy in the 3 gallons of gasoline used by the regular post office van of the same size.



BATTERY & ENGINE COMPARISONS
SUPERIMPOSED ARE APPROXIMATE REQUIREMENTS FOR A 2500# VEHICLE

These postal mission tests were done with standard lead-acid batteries. Typical of golf cart batteries, they have an energy density of 10 watthours per pound, as shown on the horizontal scale, and a power density of 50 watts per pound, as shown on the vertical scale.

The next generation of batteries, the metal-to-metal systems, will double the performance of lead-acid and last four times as long. They could be in production in two or three years.

Metal-to-air batteries will have an energy density of 50 watthours per pound and should come about the year 1985. The more exotic types with 10 times the energy density of lead-acid won't come until almost the year 2000.

ELECTRIC DEVICES FOR BOTH SUBSTITUTING FOR OIL AND GAS AND CONSERVING ENERGY

- Improved Performance Electric Heat Pumps
- Solar Assisted Electric Heat Pumps
- Heat of Fusion Storage System
- Solar Heating Pond with Templifier*
- Heat Pumps for Water Heating
- New Light Sources
- High Frequency Lighting
- Residential/Commercial Waste Heat Recovery
- Integrated Industrial Plants
- Higher-Efficiency Appliances

*Industrial Heat Pump

In many cases, electric substitution provides both lower cost to the consumer and lower total use of energy resources.

OVERALL SYSTEM EFFICIENCIES SELECTED END USES

	Electricity %	Fossil Fuel Substitute %
Heat Pump – Space Heating	70	43
Resistance – Space Heating	35	43
Templifier – Process Steam	105	60
Lighting – Fluorescent	13	<4
Heat Pump – Water Heating	105	60
Auto	19	8.5

Such lower total use of energy despite the normal losses in electric generation and transmission comes from the fact that the efficiency of the final utilization device is very much higher in the electrical case.

EFFICIENCY OF FOSSIL HEATING SYSTEMS

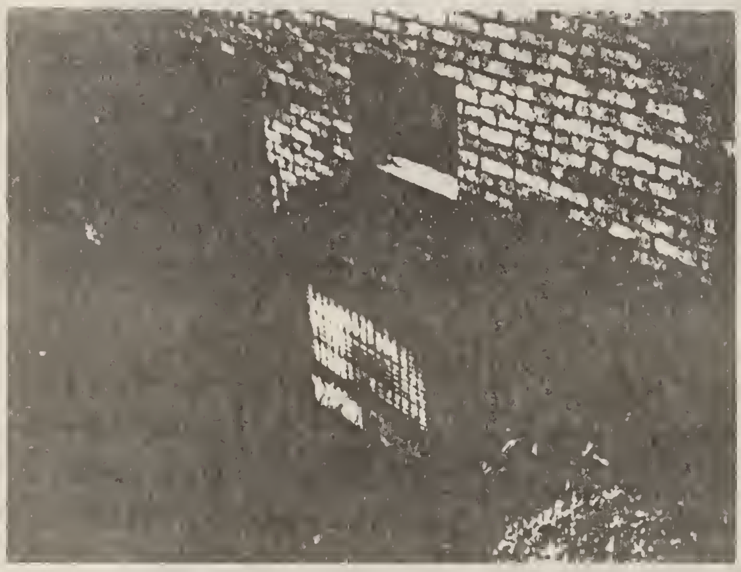
	Gas		Oil	
	% Loss	Cumulative Efficiency %	% Loss	Cumulative Efficiency %
As Manufactured		75		75
After Operation	13-20	60-70	20-33	50-60
Off Cycle Flue Loss	3-10	54-68	3-10	45-58
Combustion Air Warmup	4-8	50-65	4-8	41-56
Furnace Fan Motor	4	48-63	4	40-54
Gas Pilot Light	4-5	46-60		
Fuel Distribution	3	44-58	1	40-54
Cycling Losses			6	37-50
Insulation – Heating	15-30	31-49	15-30	26-43
Insulation – Cooling	5-10	28-46	5-10	23-41

The most obvious case is in residential and commercial space heating. Several types of resistance heating plus the heat pump and heat-by-light systems offer the user economically feasible methods for a variety of applications. But their use would be growing much faster were it not for the amount of misinformation that surrounds the subject. Most significant is the common belief that gas and oil furnaces have efficiencies in the 60 to 70% range. These are idealized figures referring to a steady-state, full-load-after-warmup operating efficiency of the furnace itself. But when a fossil-heated house is compared to an electric-heated house, several losses attendant to the fossil system must be taken into account. When they are, the normal full-load-after-warmup efficiency of 60 to 70% is seen to be reduced to about 50%. Oil furnaces are even less, and both can be considered much less if the effect of the lower level of insulation in a fossil-heated house (compared to electric) is considered.

FIELD TESTS FOSSIL VS. ELECTRIC HEATING

Test By	Buildings Tested	Heating System	F/E Ratio	Fossil Efficiency
L I Lighting	425 Homes 179 Homes	Gas Electric	2.64	37.9%
National Economic Research Assocs.	61 Homes 63 Homes	Oil Electric	2.72	37%
Gordian Assocs	66 Apartment Bldgs 18 Apartment Bldgs	Oil Electric	2.25	44%
Oklahoma Gas and Electric	219 Garden Apts 447 Garden Apts	Gas Electric	3.75	27%
Gulf States Utilities	430 Homes 220 Homes	Gas Electric	3.55	28%
Composite			2.98	33.6%

Several field test programs have been conducted to verify the relative efficiencies of various heating systems. The methodology normally involves comparing the energy used in one group of houses with electric heating, versus the energy used in another group having a fossil furnace. If electric heating is assumed to have a point-of-use efficiency of between 95 and 100%, then the comparison of energy use between electric and fossil is used to derive the efficiency of the fossil system. Values are proving to be in the 35 to 50% range. Thus, electric resistance heating at a level of 31% is not a waster of energy sufficient to offset its advantage to society as a substitute for oil and gas.



The electric heat pump is approximately twice as energy-efficient as electric resistance heating because of its unique ability to transfer usable heat from one place to another, consuming less energy in the process than the amount of heat transported. To get two units of heat, the user is only required to pay for one unit of electric energy. A combination of this so-called 200% efficiency (or Coefficient of Performance of 2), the reduced heating requirement in an electric heating insulated house, and the elimination of the capital investment involved in supplying gas to a home results in electric heating being cost-competitive in most areas of the country. Unfortunately, many builders remember the early heat pump models which were poorly designed, inadequately serviced, and did not achieve this efficiency of 200%.

RESULTS OF HEAT PUMP CASES

Reference House, Pittsburgh, Pennsylvania

Case	Technology	Resistance Heater KW	Resistance Heater Control Method	Compressor Cutoff	SPF
1	1960's	5, 10, 13.5	Thermostat: 40°, 30°, 15°F	15°F	1.19
2	"	"	Thermostat 33°, 20°, 15°F	"	1.41
3	"	"	Two Stage Thermostat	"	1.58
4	1970's	4.7, 9.4, 14.1, 18.8	40°, 30°, 15°, 0°F	No	1.38
5	"	"	35°, 20°, 5°, – 5°F	"	1.59
6	"	"	30° 15°, 0°, – 15°F	"	1.84
7	"	"	Two Stage Thermostat	"	2.03

Development efforts on the part of at least three manufacturers have created models that can provide reliable heating systems in all parts of the United States. These latter designs achieve an average efficiency over a complete heating season (Seasonal Performance Factor) ranging from 1.75 in the North to 2.5 in the South, with an average climate being about 2.0.

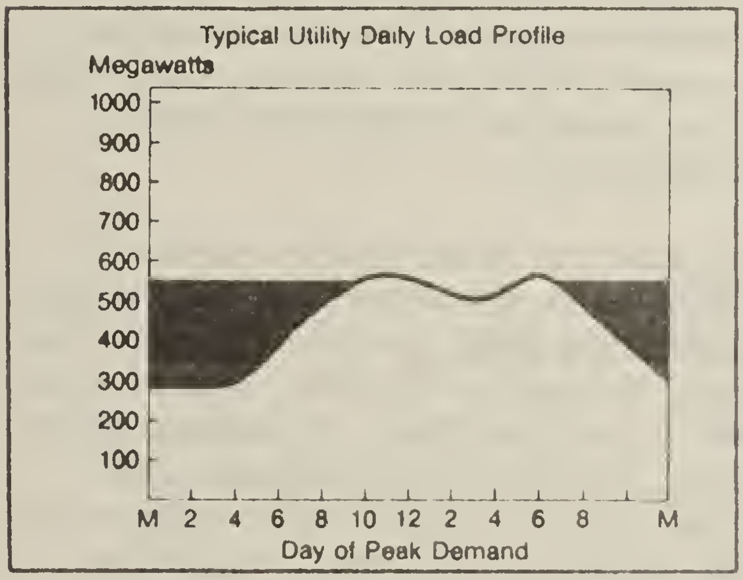
Working in conjunction with electric utilities, the manufacturers are recruiting and training new installation and service contractors in all parts of the country.

LOAD MANAGEMENT OF ELECTRICITY

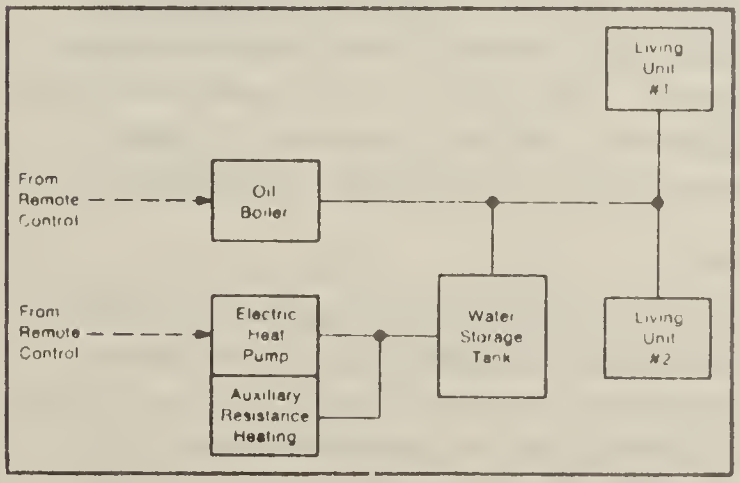
OFF-PEAK USES OF ELECTRICITY FOR IMPROVING UTILITY LOAD FACTOR

- THERMAL STORAGE
  - Residential/Commercial
  - Industrial
- OFF-PEAK BATTERY CHARGING
- HIGH TEMPERATURE (380°F) WATER STORAGE
- HEAT OF FUSION SEASONAL STORAGE
- IRRIGATION
- TIME OF DAY METERING
- REMOTE AND AUTOMATIC LOAD CONTROL
  - Central Computer Operation
  - Power Line Carrier Communication

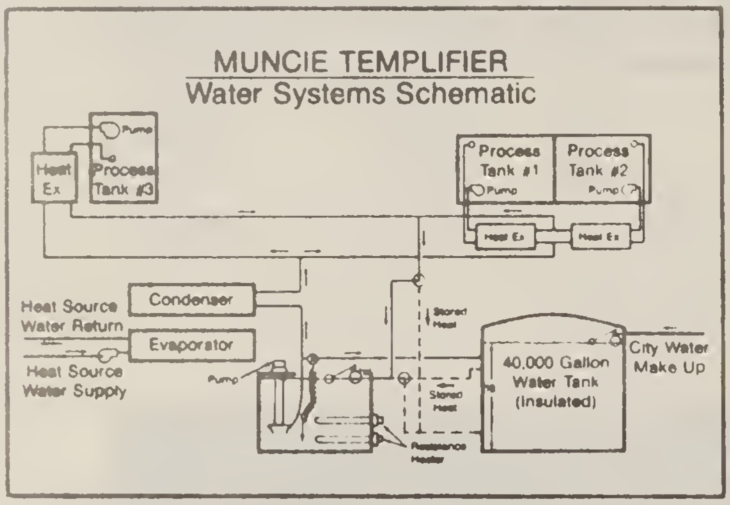
A wide variety of electricity could be switched to nighttime or weekend hours when electric utilities have idle generating capacity. To make such switching feasible will require the development of several new devices plus remote control and communication system.



The cross-hatched area on this plot represents available capacity on the day of peak demand of a winter peaking utility with a system peak of 550 MW serving a city of some 100,000 homes. That available capacity would supply 2150 megawatt hours, enough to heat 15,000 homes using thermal storage and off-peak control. Without storage and off-peak control, 15,000 homes would add 120 MW to the system peak.

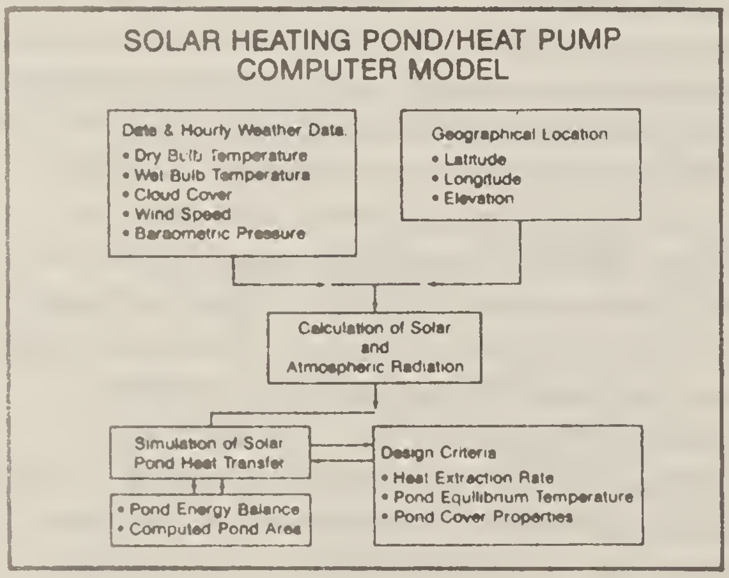


In a field test jointly sponsored by the FEA and the FPC, 10 two-family duplex apartment buildings in the city of Biddeford, Maine are being provided with alternate heating systems. A common oil boiler heats both apartments now. A combination heat pump and 500-gallon thermal storage tank is being installed in parallel with the oil boiler. Each heat pump will be provided with a solid-state clock control which will activate it in off-peak hours to pump heat into the thermal storage tank. During utility peak hours the heat pump will be turned off and the system switched to take heat from the storage system. Measurements will show the positive effect of using the storage system on the utility peak loads. A large fringe benefit of having two heating systems installed in the same building is the ability it affords to make accurate measurements of performance for the various heating modes. This will be accomplished by alternating between the oil boiler, the normal heat pump, and just the resistance elements in the heat pump. Appropriate instrumentation will measure and record energy input to each system coincident with outside weather data. Because the efficiency of electric resistance heating can be assumed as 95-100%, the efficiency of the oil furnace and heat pump can be accurately determined.


MUNCIE TEMPLIFIER
Water Systems Schematic

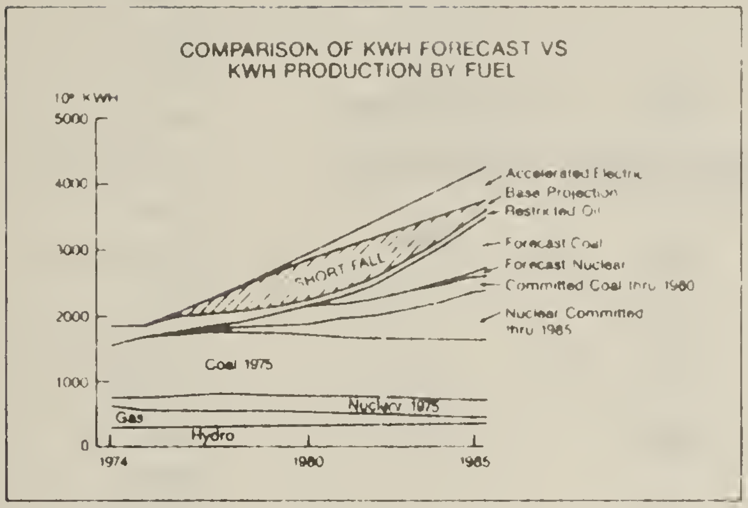
The same technology can be used in providing steam to an industrial process. A second part of the Templifier prototype test at the Westinghouse Muncie, Indiana plant involves the addition of a 40,000-gallon hot water storage tank to the system. The Templifier would pump hot water to the storage unit when the plant operations were down, which of course, would coincide with the utility off-peak hours. Then for as much as 5 or 6 hours during the day, the Templifier would be turned off and the process requirements would be supplied from the storage unit. This would remove 150 kW from the peak load, which at $700/kW, is a reduction of $100,000 in utility investment.

At the Westinghouse Research Laboratories we're developing an extension of this heat storage principle --a man-made heating pond. Located adjacent to an industrial plant, the pond would collect heat from the sun to be used by the Templifier. By adding a glass or plastic cover, the pond could double as a heat-storage system. The pond would receive heat from the sun during the day and from the Templifier at night. The heat would be withdrawn to supply the process during times of utility peak with the Templifier shut down. This system would achieve all the goals of the Electric Energy Economy: it would conserve energy, save oil and gas, and utilize off-peak power.


SOLAR HEATING POND/HEAT PUMP
COMPUTER MODEL

The feasibility of the heat-collecting/heat-storage pond has already been established by a computer simulation program. We will shortly have a physical model of the heating pond in actual operation. In addition to verifying the computer data, the model will be used to test ways and means of increasing heat absorption, and reducing losses through evaporation, convection and radiation.

GENERATION CAPACITY PROJECTION



The base case projection on this curve represents a consensus of forecasts of electricity consumption. A large shortfall can be seen between the fuel required to supply that electricity and the fuel believed available to the industry over the next several years. But if electricity is to supply an increased demand from an acceleration of electric consumption, then the fuel shortage is much greater.

Comparison of KWH Forecast vs. KWH

	1975	1980 Base Case	1980 Accelerated Electricity	1985 Base Case	1985 Accelerated Electricity
Point-of-Use Consumption (All Fuels)	57	73	65	83	70
E.U. System Loss	15	20	21	26	31
E.U. Input	20.7	30.3	31	37	43
Total Gross Energy	72	93	86	110	99.7
E.U. Kwh (10^9)	1970	2890	2950	3520	4095

To resolve that shortfall and the resulting requirement for imports by 1985 would require a great acceleration in the construction of nuclear plants which seem to offer the only hope for significant expansion in line with the fuels discussion on the following pages.

Projections of Capacity Requirement

	1975	1980 Base Case	1980 Accelerated Electricity	1985 Base Case	1985 Accelerated Electricity
Kwh (10^9)	1970	2840	2950	3520	4095
Load Factor (%)	60	60	60	61.5	61.5
Peak Load (GW)	375	550	561	746	760
Capacity (GW)	450	660	674	895	912
Hydro	72	74	74	74	74
Gas	65	48	48	17	17
Oil	70	17	17	25	25
Nuclear	39	91	105	216	386
Coal	204	268	268	420	410
Shortfall*	0	161	142	143	0

*Based on Insufficient Fuel Available

But even if fuel could be made available, the construction of generating facilities will not be adequate to provide the capacity required. The list of delays and cancellations of generation equipment due to financial or load growth reasons is more than half the total backlog of this equipment. The high amount of nuclear capacity on the list is due in part to the long lead time of nuclear capacity.

Summary of Delays

	Nuclear (NSSS)		Turbine Generators			
			Nuclear		Total	
	Delay	Cancel	Delay	Cancel	Delay	Cancel
Total Units	89	23	88	23	177	76
Megawatt Total	97244	25978	97254	25978	147188	49501
Total Megawatts	123222		123232		196689	

DELAYS AND CANCELLATIONS

DELAYED TO

Delayed To		Delayed From 1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
1975	MW	601													
	Units	1													
1976	MW	380	4915												
	Units	1	7												
1977	MW		4480	3823	504										
	Units		7	7	1										
1978	MW		980	4500	4785	1647									
	Units		4	6	9	2									
1979	MW		260	1656	4546	5771	1582								
	Units		1	3	6	10	2								
1980	MW			600	2119	3190	11112								
	Units			1	3	4	15								
1981	MW				1166	789	6792	7379							
	Units				1	1	7	9							
1982	MW					616	1050	3312	11781						
	Units					1	1	3	12						
1983	MW						400	2600	4286	5443					
	Units						1	3	4	6					
1984	MW						1100	-	2060	9095					
	Units						1		2	8					
1985	MW							2424	-	3495	5579	3025			
	Units							2		3	5	3			
1986	MW								793	-	2455	3559			
	Units								1		2	3			
1987	MW								1211	3251	-	-	2359		
	Units								1	3			2		
1988	MW												-		
	Units														
1989	MW												-		
	Units														
1990	MW												1211		
	Units												1		
1991	MW														
	Units														
1992	MW													1211	
	Units													1	
Indef:	MW	-	579	1300	-	1228	1572	3705	3306	2399	1300	2100	-	1300	
	Units		2	1		2	3	4	*3	2	1	2		1	
Net MW Slipped		981	11594	18178	22995	25467	35195	36012	43323	50247	46852	43281	32328	28032	
Canc.	MW	25	-	1771	3856	5361	3556	1846	1070	3461	4887	-	2001	-	
	Units	1		6	10	8	6	4	2	3	5		2		
Canc. to Date		25		1796	5652	11013	14569	16415	17485	20946	25833	25833	27834	27834*	

*Does not include those cancellations for which there was no original date.

A significant reduction in the shortfall in capacity (and the utilities' financing problems) could be made by improving the utility load factor through "Load Management" or using electricity during off-peak hours.

Generation Capacity Requirements of
Accelerated Electricity Case
vs.
Load Management Case in 1985

	Accelerated Electric	Load Management
Kwh (10^9)	4095	4095
Load Factor (%)	61.5	65
Capacity (GW)	912	866

FUELS FOR ELECTRIC GENERATION

Regardless of the national rhetoric during the last year about reducing American dependency on foreign oil, there are still no guidelines, policy, or realistic proposal to significantly reduce our need for foreign petroleum which do not entail curbing our standard of living. Should the growth rate of energy continue its historic rate of 4 percent per annum and electricity resume its annual growth pattern near 7.5 percent, we shall have increasing needs for all fuels. Even with reduced growth, this is true. Before the end of the decade, there will be a serious discrepancy between the demand and supply of these fuels.

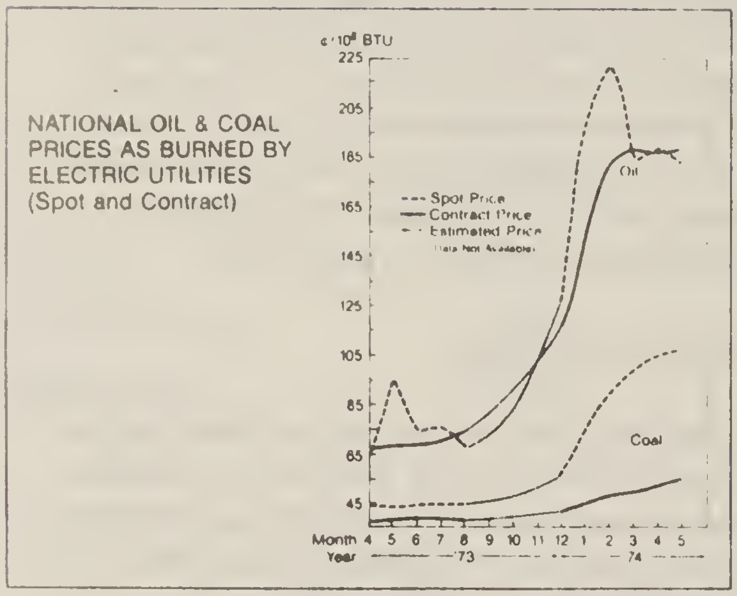
Constraints to Coal Production

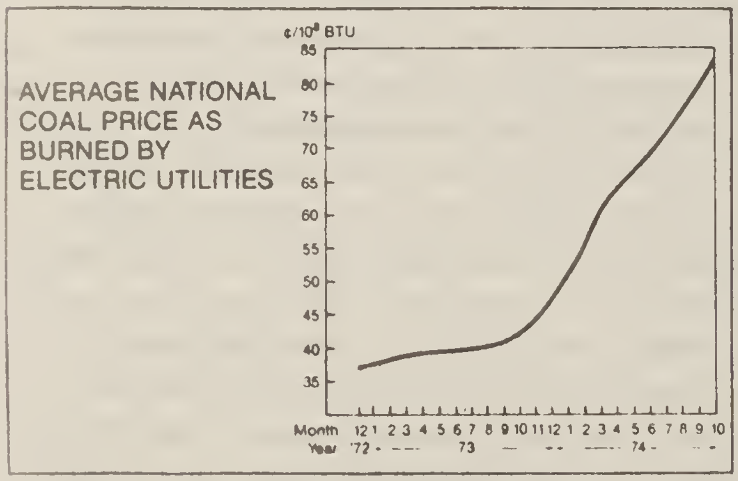
Both the coal industry and the Bureau of Mines agree that coal must at least double its present production by 1985. However, when one considers the shortages of manpower and material, lengthening lead times for mining equipment, and the subsequent stretching of lead times to open new mines (7 years for an underground mine, 5 years for a surface mine), it is doubtful that coal can substitute significantly for other fuels. And to further compound this problem, if the Clean Air Act, which allows for .7 percent of sulfur by weight, actually goes into effect July 1, 1975, this will preclude the use of over 200 million tons per year from the high-sulfur coal supply. This loss would represent an amount equal to one-third the current total production of coal and almost one-half this year's utility coal burn or 25 percent of all power generated. Even if the Clean Air Act deadline is extended a year or two, unless there is a permanent resolution of EPA requirements, the electric utilities will not sign long-term coal contracts. In addition to these supply and environmental restrictions, transportation is an additional bottleneck. The Eastern railroad system would require over a $6 billion capital investment for refurbishment; key river navigation is cumbersome and has started to reach saturation; coal slurry lines are not yet available.

All of this severely constrains a high rate of growth in the coal industry. In fact, due to these constraints, it is possible that the 1980 electric utility coal burn could be one-half the 1974 burn instead of 50 percent above it. Since two-thirds of the total coal production is used to generate electricity, this will be a significant loss to the industry.

Coal Prices

Coal, although it is 90 percent of our domestic fuel resource base, supplies only 17 percent of our national energy needs. Coal production has not increased appreciably since 1943, but it became important after the Arab oil embargo. At that time, the price of foreign oil quadrupled and coal prices soared 200 to 400 percent.


NATIONAL OIL & COAL PRICES AS BURNED BY ELECTRIC UTILITIES (Spot and Contract)


AVERAGE NATIONAL COAL PRICE AS BURNED BY ELECTRIC UTILITIES

The dramatic leap in coal prices month by month has been caused by coal suppliers taking advantage of the increase in oil prices. Since oil and coal are purchased on the basis of cost per delivered BTU (less some premium for form), there is no logic in the coal supplier keeping his price substantially below the price of the competing oil in the short term.

Because new mines cannot be immediately opened, the spot market for uncommitted coal becomes extremely lucrative, and the operator can virtually name his own price. This causes small companies to default on their supply contracts in order to take advantage of the spot market, which brought as much as $50 and $60 a ton. TVA, the largest single consumer of coal, has been paying as much as $20 to $40 per ton in recent months, compared to $7 to $10 per ton in 1972. This price spread induced TVA to consider the purchase of Peabody Coal Company to establish a captive supply. Price hikes and breech of contract by small companies have not only interrupted normal business relationships but have caused the consumer much higher prices in electricity through automatic fuel-adjustment clauses. Although the coal industry is clearly making more money than it has in many years, the lack of firm long-term contracts means that they still are not taking the risk to allocate money to finance new mines.

COMPARISON OF TYPICAL WESTERN AND EASTERN COAL MINE COSTS PER TON

	Capital Cost (17% F.C.R.) $/Ton	Labor Cost ($50/Day) $/Ton	Total Cost $/Ton
Eastern Underground	3.40	4.07	7.47
Western Surface	1.70	.30	2.00

Coal is costly to mine and transport, and due to sulfur restrictions, not all coal can be burned. Ironically, most of the low-sulfur coal is in the West where it can be easily and far more reasonably mined. Yet, there are still strong environmental legislative hurdles to cross and Federal leases to open before Western lands can be easily strip-mined. To give some idea of the cost differential of Western surface mines and Eastern deep mines, one can examine the capital and labor cost differences in this chart, which shows that Eastern coal costs almost four times as much per ton.

In addition, Western strip mines are not only considerably less hazardous to men than deep mines, but they are more productive. And, because Western mines are less labor-intensive, the new wage contracts will not make as big an impact on coal costs as in the East.

RECLAMATION COSTS

Seam Thickness	Tons of Coal Per Acre	BTU × 10^6 Ton	Reclamation Cost ($1500/Acre) ¢/Ton	
			¢/Ton	¢/MMBTU
35′	57,150	15	2.62	0.175
75′	122,500	16.2	1.22	0.075
80′	130,600	16	1.15	0.072
52′	85,000	19	1.76	0.093
16′	26,000	13.8	5.76	0.417

Environmentalists argue that strip mining will destroy the land. Reclamation, however, is not only technologically but economically feasible. Reclamation costs are minimal; they would amount to from .1 to .4 percent of the cost of mining.

Therefore, one can see that although coal is by far our most abundant fossil fuel, significant Government policy decisions must be made to insure its exploitation. These include:

- Permanent EPA rules on high-sulfur coal use
- Strip mining
- New land leases
- Vast railroad (and water transportation) restoration.

Given resolution of these problems, the following facts about coal's future are assured:

- Manpower and occasional temporary material shortages will constrain production
- New mines will be opened only with firm, long-term contracts.

Oil Availability

Since current oil production is at maximum production levels in the United States, Venezuela and Canada, additional oil supplies must come from the Middle East which contains 60 percent of the world's oil reserves. Currently, 47 percent of the residual oil consumed in the U.S. is used by electric utilities; very little comes directly from the Middle East, but is the product of European refineries using Middle East crude oil. Should there be a war or continued political instability, Venezuela might decide to share her oil with Europe, further reducing our supply. In this event, it is not unreasonable to assume that the 1980 oil burn could be only 80 percent of our 1973 oil burn. Since oil has been the short lead-time fuel, considering the extent of cancellations and delays by electric utilities of all types of equipment, the use of oil could increase even more rapidly in the next five years, which is counter to national energy goals.

Oil Prices

There is a growing feeling in international economic circles that the present price of Mid East oil is higher than the price which maximizes monopoly profits. Most economists predict, therefore, that the Middle Eastern nations will keep the price constant, allowing inflation to reduce its effective price to the optimum monopolistic level. However, there is a world surplus of oil production which is exacerbated by the present world economic recession, and such nations as Iran, who at present are able to utilize every incoming petrodollar, will have strong pressures to increase production even if it requires a reduction in price. Such a policy could lead to both the breakdown of world oil prices and the OPEC cartel.

In addition, however, those countries which are unable to spend their vast oil revenues have a positive incentive to reduce production to a level which generates a magnitude of funds more in line with their investment potential. Such a policy may severely restrict supply in the face of continuing demand, creating positive pressures to further increase prices. This situation would be a positive incentive to importing nations to examine most carefully every available energy alternative. In the long term, therefore, world demand for oil could shrink to match this restricted supply. These occasional supply dislocations could encourage the establishment of an oil shale industry; however, we would expect OPEC to then react with lowered prices temporarily to keep us dependent upon them. This "seesaw effect" further demonstrates our urgent need for a strong national energy policy which encourages nuclear and coal.

Nuclear Fuel

The price of U_30_8 is also following the upward price behavior of oil and coal. Supply and costs will be unstable, especially in the 1980's. Enrichment capacity will be in short supply by the early 1980's unless new capacity is committed within the next two years. However, the type of facility, the location of the plant, and the ownership are still being debated with no visible progress toward resolution. Reprocessing costs and procedures have not yet been developed and the AEC has not yet issued the final safety and environmental regulations. This indecision means that the utilities will neither have spent fuel storage nor a knowledge of total fuel cycle costs. In addition, concerns over security of transporting and storing plutonium has generated considerable public attention by the anti-nuclear movement. If these problems are not resolved in the near future, nuclear power production will fall even further behind our latest 1985 forecast.

Today there is no viable nuclear fuel cycle industry. This is true for several reasons:

- It is an emergent business
- Lead time between investment and realization of revenue is 8 to 10 years
- High capital intensity ($3-4 of investment per $1 of annual revenue)

- Uncertainty over Government regulation
- High capital investment ($45-50 billion over the next 25 years in 1974 dollars).

In addition, there are bottlenecks in the exploration, mining and milling of uranium as well as enrichment. Also, a clear licensing procedure is not yet available for the plutonium recycle. However, a smooth transition between the AEC and NRC will be necessary in order that the Government provide some assurances. Unless decisions are made soon, we face a shortfall of nuclear fuel by 1985.

Even though nuclear fuel costs are more stable than fossil, there is strong inducement for a utility to install coal capacity. First, fuel pass-through clauses allow the greater cost of coal to be passed on directly to the consumer. Second, and of perhaps greater present importance, installed capital costs of coal-fired plants are less than the cost of an equal-sized nuclear unit. Third, since construction of a coal-fired plant takes approximately 4 years less than a nuclear plant, the facility can be placed in the rate base almost twice as fast. Fourth, in a special case of Western coal, its delivered price is considerably lower than the delivered price of Eastern coal. This affects the economics of the coal-nuclear tradeoff such that utilities in reasonably close proximity to these fields can justify coal over nuclear.

Generation Economic Comparison Vis-A-Vis Fuel

In 1974 nuclear power had from 33 to 50 percent higher capital cost per kilowatthour than coal and oil respectively. Fuel costs vary widely, with nuclear 45 percent the coal rate and less than 15 percent that of oil. With operations and maintenance costs assumed as equal, nuclear energy is slightly more economic than coal and considerably more economic than oil.

WESTERN COAL COMPETITIVENESS

	Case I	Case II
Capital Cost Nuclear Over Coal Without SO_2 Cleanup	$100/KW	$200/KW
Cost of Nuclear Fuel	24¢/MB	26¢/MB
Cost of Powder River Coal	20¢/MB	38¢/MB
Freight Rate	6 Mills/Ton Mile	10 Mills/Ton Mile
Fixed Charge Rate	17%	17%
Breakeven Coal Haul	800 Miles	691 Miles
Heat Content MM BTU/Ton	16.5	18.4

COMPARISON OF GENERATING COSTS
1974 – Assume 65% Capacity Factor

	Coal	Oil	Nuclear
Capital Cost $/KW	300	270	400
Fixed Charge Rate %	17	17	17
Mills/KWHR (Capital) $\frac{\text{Capital Cost} \times \text{Fuel Cost}}{8760 \text{ Hrs} \times 65\%}$	8.96	8.06	11.94
Fuel (Average May 1974) ¢/MM BTU	65	188	26
Heat Rate BTU/KWH	9000	9500	10200
Mills/KWHR (Fuel) Heat Rate x Fuel Cost	5.85	17.86	2.65
Operation & Maintenance Mills/KWH	1.0	1.0	1.0
Total Owning and Operating Cost (Mills/KWH)	15.81	26.92	15.59

SENSITIVITY ANALYSIS OF GENERATING COSTS FOR INCREASES IN FUEL, INTEREST CHARGES AND CONSTRUCTION COSTS

	Coal		[illegible]		Nuclear	
	Mills/KWH Incr	% Increase in Total Cost	Mills/KWH Incr	% Increase Total Cost	Mills/KWH Incr	% Increase in Total Cost
10% Increase in Fuel	58	(+3.7%)	[illegible]	+6.6%	[illegible]	[illegible]
10% Increase in U_3O_8					08	(+0.5%)
10% Increase in Interest Charges	53	(+3.4%)	47	(+1.7%)	70	(+4.5%)
10% Increase in Construction Costs	90	[illegible]	[illegible]	(+3.0%)	[illegible]	[illegible]

Nuclear is by far the least sensitive to fuel costs. In addition, it is important to note that since the major portion of the fuel cost is in fabrication, the price of fuel is especially insensitive to price increases in U_3O_8. On the other hand, nuclear is the most sensitive to capital costs of all types.

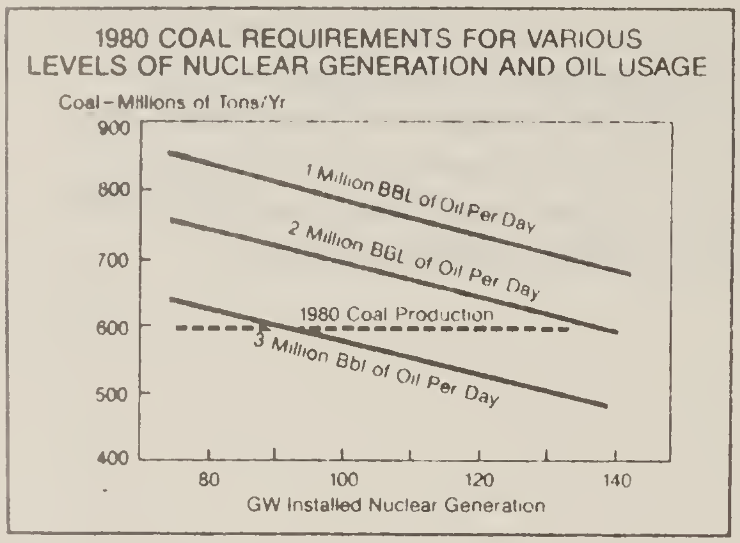
Effects of a Fuel-Constrained Forecast

KWHR ($\times 10^9$) PRODUCTION BY FUEL

	1973	Forecast 1980	Expected With Defaults 1980	Possible % Short Fall
Nuclear	81	466	400	-15%
Coal Steam	834	1353	675	-50%
Oil/Gas Steam	642	898	539	-40%
Conv. Hydro	265	303	303	0
P.S. Hydro	11	20	13	-35%
Comb. Cycle	2	10	6	-40%
Gas Turbine	40	52	31	-40%
Total (Net)	1875	3102	1967	-37%

When one considers all the problems outlined herein, it is quite possible that the constraining force in kWh production will be fuel availability. This chart compares the 1980 kWh forecast with a possible fuel-contrained forecast. It is exceedingly important to note that the most stable fuel is nuclear. All other fuels could have an extremely significant shortfall ranging from 40 percent for oil/gas to 50 percent for coal. In addition, environmentalists have been successful in essentially stopping pumped storage/hydro.

If such a series of events took place, its effect on the nation could indicate severe economic consequences, for there would be no growth in this decade. This further points to the necessity of a national policy with requisite industrial implementation to preclude such a catastrophe.

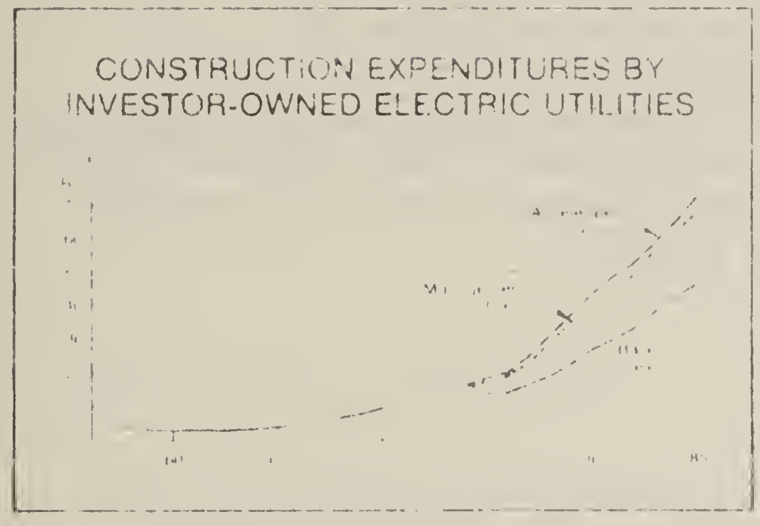

1980 COAL REQUIREMENTS FOR VARIOUS LEVELS OF NUCLEAR GENERATION AND OIL USAGE

To demonstrate the interrelationship of the many competing Governmental actions and energy pronouncements, it is informative to analyze the impact of President Ford's goal of reducing oil usage for base-load generation by one million barrels per day in 1980. Alternatives to this capacity are either coal or nuclear power. These curves demonstrate the necessary tradeoffs between coal and nuclear to reduce oil consumption. If one million barrels of oil per day were removed from the electric utility sector, approximately one million barrels per day would remain for intermediate and peaking duty.

Our best estimate of installed nuclear generation in 1980 is 88 GW. To limit oil usage to one million barrels of oil per day would require 820 million tons per year of coal. Yet 1973 usage was only 388 million tons. Thus, coal production would have to increase over 100 percent. However, our best estimate of coal availability to the electric utility industry is slightly under 600 million tons, a shortfall of nearly one-third. Moreover, as has already been noted, there is a good possibility of 1980 coal availability being even less than the 1973 level. Thus, the interrelationship of policy proposals in the energy field is abundantly clear.

ELECTRIC UTILITY FINANCING

Required Construction Expenditures



CONSTRUCTION EXPENDITURES BY INVESTOR-OWNED ELECTRIC UTILITIES

Annual construction expenditures by investor-owned electric utilities in current year's dollars, actual from 1957 to 1973, and required for the Base, Accelerated Electric, and Load Management cases are plotted on the left. The following tabulation shows the 74-85 cumulative construction expenditures in billions required for the three cases and, for comparison, actual cumulative expenditures for the like period 62-73:

62-73 Actual	74-85 Base	74-85 Accelerated Electric	74-85 Load Mgmt.
91	322	492	461

Two observations are pertinent. First is that even the Base case entails massive spending compared to 62-73. Second is that to shift from the potentially disastrous Base case to either the Accelerated Electri case or the more capital-efficient Load Management case will require $140 to $170 billion of additional construction expenditures.

Electric Utility Financial Environment

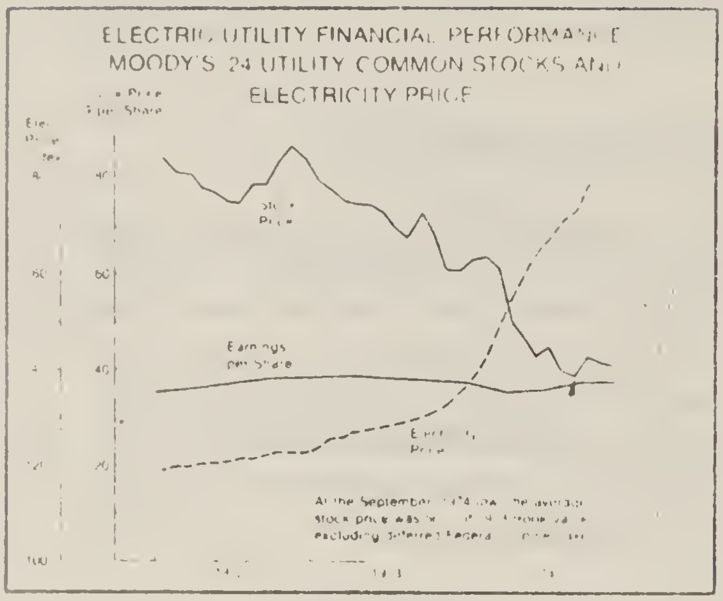
FACTORS AFFECTING ELECTRIC UTILITIES' PROFITS AND SECURITY SALES

Developing Factors
Growth dictated by nation's needs
Escalating construction costs
Escalating plant scope including environmental protection equipment
Escalating construction work in progress balances caused by longer construction schedules and start up delays

Occurring in 1974
Sharp rise in fuel costs
Low load growth
Higher interest rates
Consumer resistance to rate increases Regulatory lag

Rapidly rising construction costs and escalating plant scope, including environmental protection means, had by 1973 substantially increased utility investment and had necessitated an upturn in the price of electricity in 1971--ending a virtually unbroken string of annual price declines going back to 1947. A combination of low load growth in 1974, higher fuel prices, higher interest rates, and consumer resistance to rate increases has placed utilities in a severe profit squeeze at the very time they need massive securities sales to finance new construction.

Effect on Ability to Sell Securities



The securities markets reacted promptly and decisively to the utilities' worsening profit situation. Declining interest-coverage ratios prompted successive lowerings of bond ratings, thus adding to the cost of debt. Utility stock prices declined all out of proportion to the decline in earnings per share. At its low point in September 1974, Moody's 24 Utility Common Stock average was only 56 percent of 1973 year-end average book value. Recent issues of BBB-rated five to seven year bonds have sold at prices to yield 12-3/4 to 13 percent.

Will investor-owned electric utilities be financially viable and able to finance required construction expenditures?

In view of 1974's dismal picture, the question arises whether investor-owned electric utilities will be financially viable and whether they will be able to finance the $322 billion of construction expenditures required in 74-85 for the Base case above, much less the additional $140 to $170 billion required for the Accelerated Electric and Load Management cases. Stated differently, will a shift in the national interest to coal and nuclear-fueled electricity to replace present oil-fueled uses be restricted by inability of electric utilities to obtain necessary capital funds?

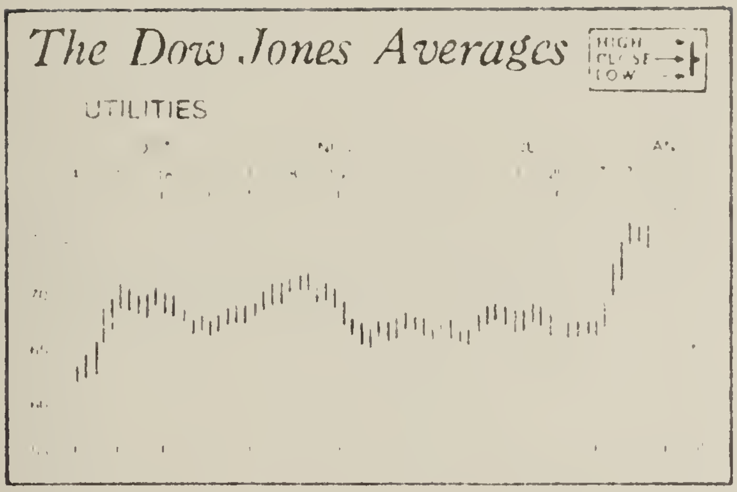
The question breaks down into these main parts:

- Financial viability of electric utilities
- Possible future national capital shortfall
- Ability of electric utilities to attract their capital requirements in competition with other industries.

Financial Viability of the Electric Utility Industry

At the stock prices and bond yields prevailing in late 1974, investor-owned electric utilities were not financially viable. Equity capital was out of the question with stock prices at 60 to 70 percent of book value. Utilities thus had to turn to debt, much of it short-term. A few utilities were prevented by protective covenants in existing debt instruments from additional bond issues.

Going into 1975, short-term interest rates are falling; inflation in fuel and other costs should be much lower than in 1974; delays in construction plans will slow down the rate of new capital required; rate increase requests now held up by the regulatory lag can begin to catch up with costs; and there will be some load growth over 1974 despite continuing economic recession.



All of this has contributed to an encouraging year-end rally in utility stocks. During the last two trading days in 1974 and the first two in 1975, the Dow Jones utility average rose 14 percent (compared to a rise in the Industrials of 6 percent). Consolidated Edison stock is now just under 12 compared to its 1974 low of 6. Florida Power, particularly hard-hit by oil prices, has rebounded to 16-3/4 from its 1974 low of 10-7/8.

The point is that electric utilities can sell securities at viable costs if--but only if--yields on common are attractive and if earnings are high enough to maintain acceptable interest-coverage ratios. This in turn is dependent on prompt approvals by regulators of adequate rate increases.

When the projections of demand and supply of capital funds are offset it is clear that a cumulative savings gap of nearly $650 billion is in prospect. This capital shortfall, averaging $53.8 billion a year over the 1974-1985 period, represents approximately 13 percent of the average demand for funds over the period.

The projected shortage of capital will have a particularly severe impact on domestic business activity, on the position of the U.S. in international economic affairs, and ultimately on the standard of living and quality of life in America.

Excerpted from The Capital Needs and Savings Potential of the U.S. Economy: Projections Through 1985, published by the New York Stock Exchange, September 1974.

Possible Future Capital Shortfall

Virtually all major industries contemplate massive 74-85 capital spending. In this respect the electric utility industry is not alone. If there should develop a national capital shortfall as this excerpt suggests, competition for capital funds will be unusually severe and the real problem will be one of allocation. Some hope can be gained from other projections which indicate that savings will balance capital demand and that there need be no capital shortfall.

The problem for electric utilities is that their 74-85 requirements may constitute a larger-than-historical proportion of total capital spending over that period. But the cost of the utility facilities is but a small part of the total GNP the facilities make possible. For example, a new office building costing $25 million to construct would require only $2.5 million invested in utility facilities to serve it.

In that respect, it is important to keep in mind the major shifts that will be occurring in the mix of capital spending among the various energy industries. For example, spending in the coal sector will increase. However, if oil and gas consumption were maintained at the level of 1972, or at that level which could be provided by domestic suppliers, we would eliminate the need for $40-50 billion of new refineries, offshore superports and supertankers, and pipeline and transportation equipment. Also, substitution of coal and uranium for oil and gas consumption are estimated to result in fuel savings of $75 billion by 1985, much of which would go to reduce foreign payments.

Moreover, as shown above, institution of sound load management could reduce 74-85 capital requirements over the Substitution case by $30 billion.

Ability of EU's to Compete for Capital Funds
Despite their capital funds requirements being the largest of any single industry, electric utilities have had no problem in selling required securities. Earnings per share have grown consistently and dividends have been high and secure.

The difference now is that this performance cannot be maintained in the face of rising construction and fuel costs without price increases which for periods of time may have to be at annual rates higher than those of prices generally.

Whether politically-sensitive regulators will grant the necessary rate increases, including judicious changes in rate structures, and do so without undue delays in the face of consumer resistance will determine in large measure whether investor-owned utilities remain financially viable and attract required capital.

National, state, and local takeovers of utilities will not change the problem. National interests dictate the need to move away from dependence on oil and gas and toward increased use of coal and uranium through electric substitution. Capital funds which will be required will eventually have to be forthcoming -- whether under the present regulated but privately-owned utility set-up or with the industry taken over by government agencies.

What we must avoid is a situation in which a shortage of capital, for whatever reason, prevents the nation from moving toward reduced dependence on oil and gas.

1986-2000

Electric utility capital requirements will be accentuated in 1986-2000 for the Accelerated Electric and Load Management cases, in part because restraints of time and capital limit the progress which can be made between now and 1985. A rough measure can be gained by comparing the amount of new generating capacity in gigawatts required in the 74-85 interval with that for the 86-2000 interval.

	New Generating Capacity Reqd.-GW		
	Base Case	Accel. Elec. Case	Load Mgmt. Case
1974-1985	377	577	547
1986-2000	790	1450	1230

Some argue that 1986-2000 presents an impossible situation and that growth in energy consumption must therefore be made to approach zero, through extreme conservation measures.

Experience dictates that zero energy growth would mean economic disaster--a situation we and the next couple of generations are not likely to countenance.

We should keep in mind that the financing problem we face in the 12 years between now and 1985, when compared to that of the past 12 years, is no less severe than that of 1986-2000 compared to 74-85. Just as the 74-85 problem, while difficult, does not now appear impossible, so will the 86-2000 problem not appear quite as insurmountable in 1985 as it now appears.

Certainly, we should not be deterred from moving in the right direction now by undue pessimism concerning 1986-2000.

Appendix - G

ENVIRONMENTAL ASPECTS

Environmental Quality in an Electric Energy Economy

ENVIRONMENT FOR A FUTURE CITY
Environmental Quality Index 1970 = 1.000

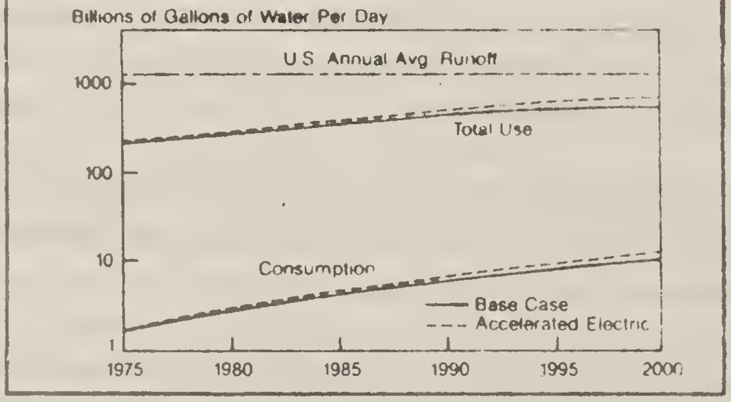
Population	1970 4,000,000	2000 6,000,000	
Energy use	10.8X10^{14}BTU/year	1970[1] energy pattern 33.0X10^{14} BTU/year	Optimum[1] electricity pattern 28.5X10^{14}BTU/year
Ambient air quality:			
Sulfur oxides	1.000	1.8	0.7
Nitrogen oxides	1.000	2.4	0.8
Particulates	1.000	1.7	0.6
Carbon monoxide	1.000	0.9	0.1
Unburned fuel	1.000	1.4	0.5
All pollutants	1.000	1.4	0.4
Ionizing radiation[2] m/rem/year	1.000	1.00006	1.00032
Atmospheric heat flux from energy use,[3] BTU/ft^2/hr	18	55[4]	35[4]
Index	1.000	3.1	2.0

1 Assumes continually improving pollution control
2 Includes all sources except medical
3 Average solar flux 58 BTU/hr/ft^2, maximum solar flux 380 BTU/hr/ft^2
4 Assumes unused power plant discharge heat is removed by river

Although continuing improvement in air pollution control will significantly reduce emissions from individual units, overall increases in combustion will result in deteriorating air quality if current energy use patterns are followed. The same holds true for the atmospheric heat flux generated by waste heat discharges. Electrical substitution, however, provides the opportunity to check the steady decline in environmental quality, and in the case of air pollution, reverse the trend. With higher conversion efficiencies and more effective pollutant emission control, substitution of electricity generated from coal and uranium for the direct combustion of oil and gas will result in improving our nation's environment.

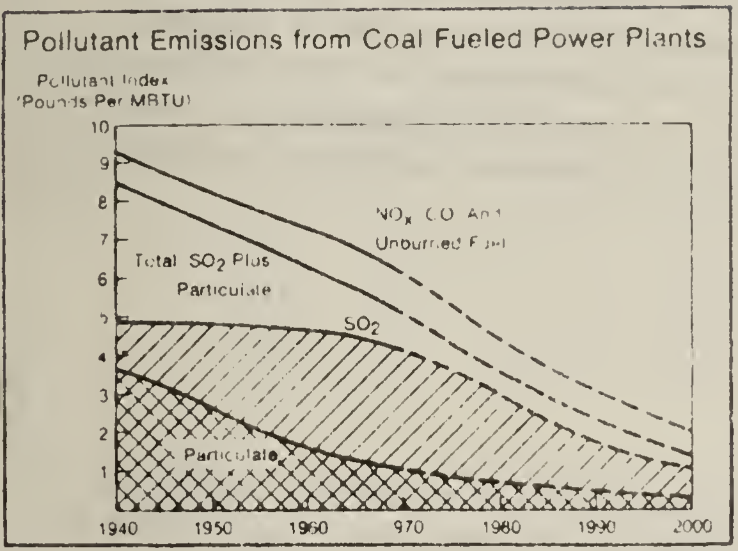
Availability of Power Plant Cooling Water

FRESH WATER USE BY THE U.S. ELECTRIC POWER INDUSTRY
(STEAM ELECTRIC POWER PLANTS)



Steam electric power plants require a large source of water for condenser cooling. As electric generating capacity increases throughout the remainder of this century, water requirements will also rise. However, the need for water will actually decline on a per-unit basis as more and more new plants turn to closed recirculating cooling systems. Even considering the accelerated electric case in which additional generating capacity is required, total water requirements are less than one-half the average U.S. stream flow (run-off) of 1260 billion gallons per day. The major portion of this water is returned to the water source where it is available for still further use. Only one percent of the run-off is actually consumed by generating plants.

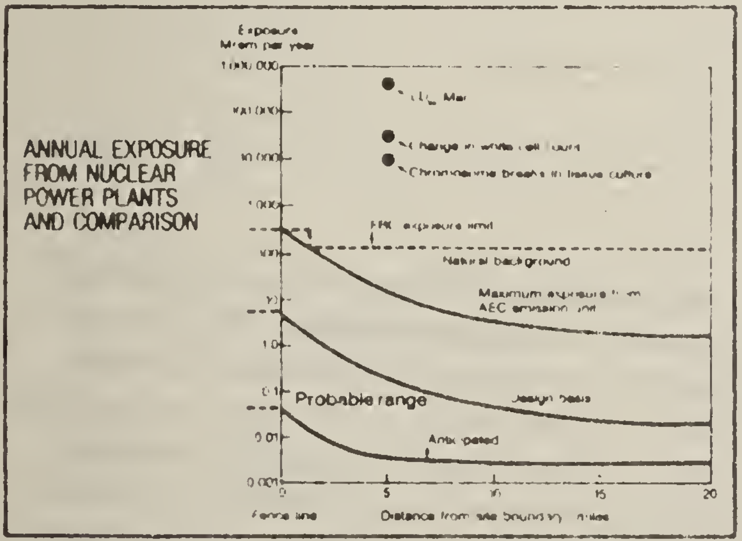
Environmental Performance of Coal-Fueled Power Plants



Pollutant Emissions from Coal Fueled Power Plants

Continuing improvement in air pollution control equipment will produce a marked reduction in the atmospheric emissions of coal-fueled power plants. With the introduction of 80% effective flue gas desulfurization equipment in the period of the late 70's to 1990, and 90% effective controls beyond 1990, the pollutant index for SO_2 will decline by nearly 70% (from present levels) in the year 2000. Fly ash removal efficiencies of 99% for newly installed units will reduce particulate emissions in the year 2000 to less than 30% of their current values.

Environmental Performance of Nuclear Power Plants



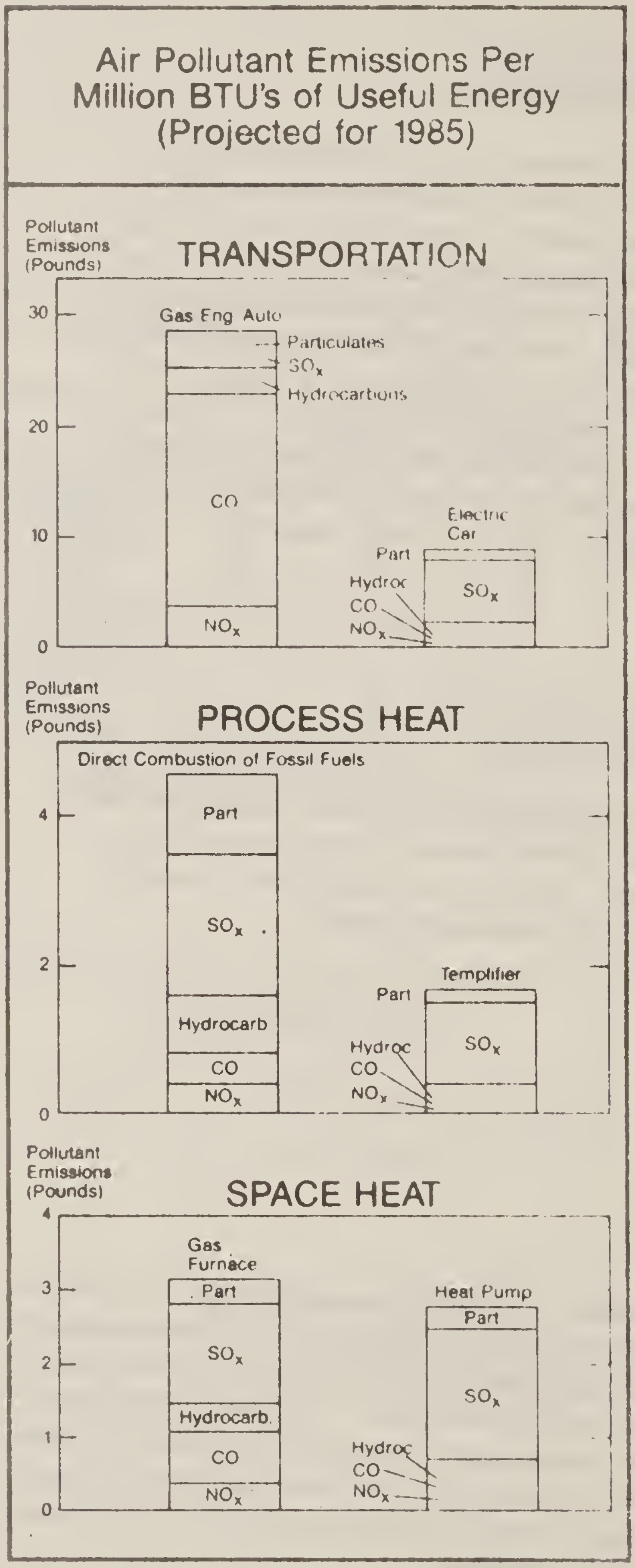
ANNUAL EXPOSURE FROM NUCLEAR POWER PLANTS AND COMPARISON

Compared to the natural background radiation level and the lowest levels at which health effects have been observed, radiation exposure due to nuclear plant operation is extremely small.

ANNUAL AVERAGE RADIATION DOSAGE

Source	Annual Dosage (mrem/yr)
Cosmic Radiation at Sea Level	40
Elevation Above Sea Level (e.g. Pittsburgh Pa	12
Ground (U S Average)	15
Building Construction Materials	7
Water Food Air (U S Average)	30
Air Travel (6,000 miles/yr)	4
Black & White Television (3 hours/day)	<0.1
Color Television (3 hours/day)	0.1-6
Chest X-ray (1 per year)	150
Dental X-ray (1 per year)	20
U S Average Dose	150-200 mrem/yr
Typical Nuclear Power Plant at Site Boundary	5-10 mrem/yr

Annual average radiation dosage from normal sources is 150 to 200 mrem/yr. Living at the fence bordering a nuclear power plant would add only 5 or 10 mrem/yr in the worst anticipated case. This adds less than living at an elevation of 1,000 feet compared to living at sea level. It is almost the same as the radiation received from one flight from New York to California and back at 30,000 feet.

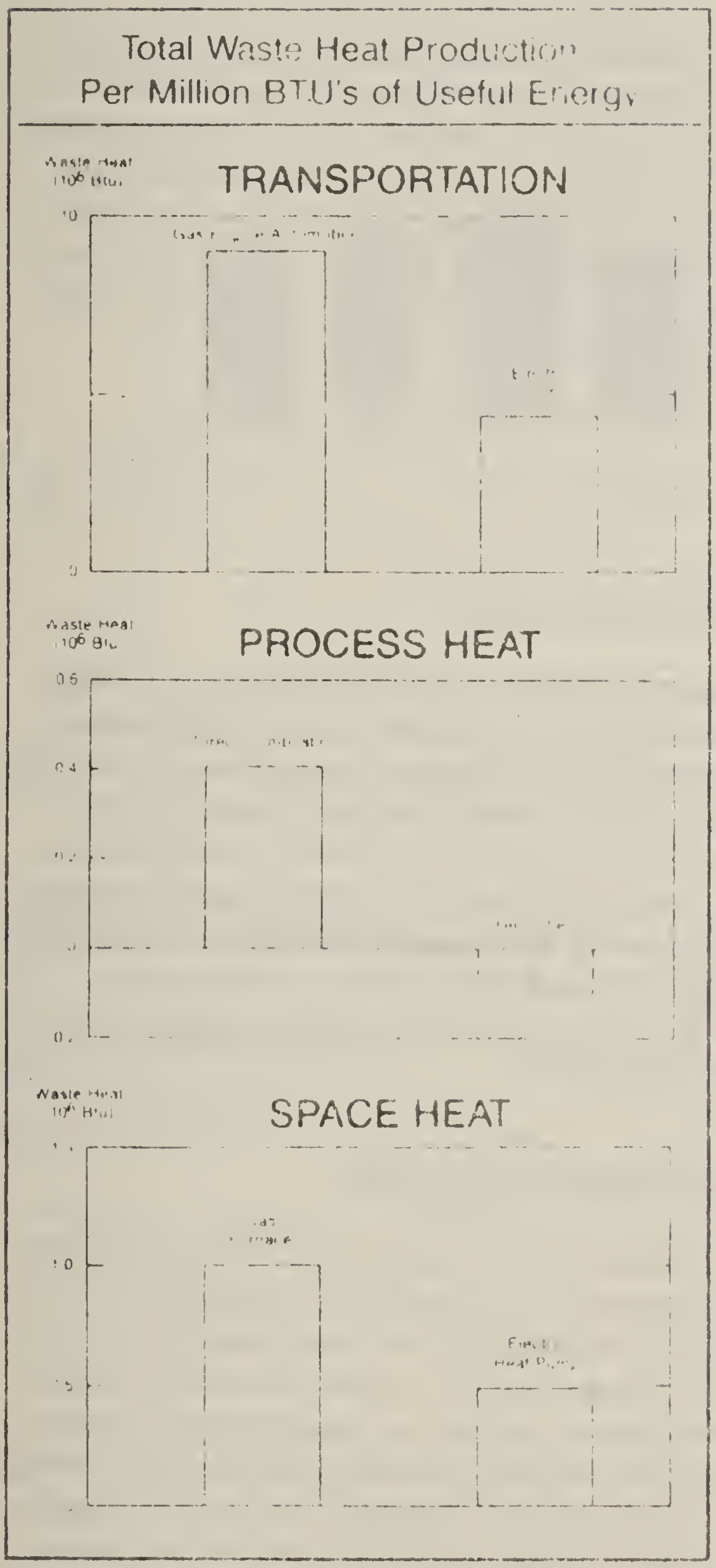

Air Pollutant Emissions Per Million BTU's of Useful Energy (Projected for 1985)

Electrical Substitution and Air Quality

An examination of their respective energy transformation processes reveals that 2-1/2 times as much energy is required to power a gas-engine car as an electric car. In the production of equivalent amounts of useful work (10^6 BTU), a significant reduction in total pollutant emissions is achieved by the electric car. Emissions for the electric car are based upon a steam electric generating fuels mix of 43% coal, 42% nuclear and hydro, and 15% oil and gas.

Substitution of the electrically powered Templifier for direct combustion of fossil fuels would result in reduced air pollutant emissions as projected for 1985. The electricity generation mix is the same as noted above.

By utilizing the outside environment as its energy source as opposed to fuel combustion, the electric heat pump typically operates at efficiencies in the range of 200%. Consequently, more fuel is required to heat a home by direct fuel burning in a furnace than is needed to generate the electricity to operate a heat pump. The emission quantities for the heat pump are based on the same electricity generation mix of 43% coal, 42% nuclear and hydro, and 15% oil and gas. In the period 1985 to the year 2000, it is predicted that pollutant emissions from coal plants will decrease by 50% while space heating will experience only an 11% reduction. Consequently, as cleaner coal-burning power plants and more nuclear capacity are added to the electrical energy mix, the heat pump will become an ever increasing choice for space heating as the method of least pollution.



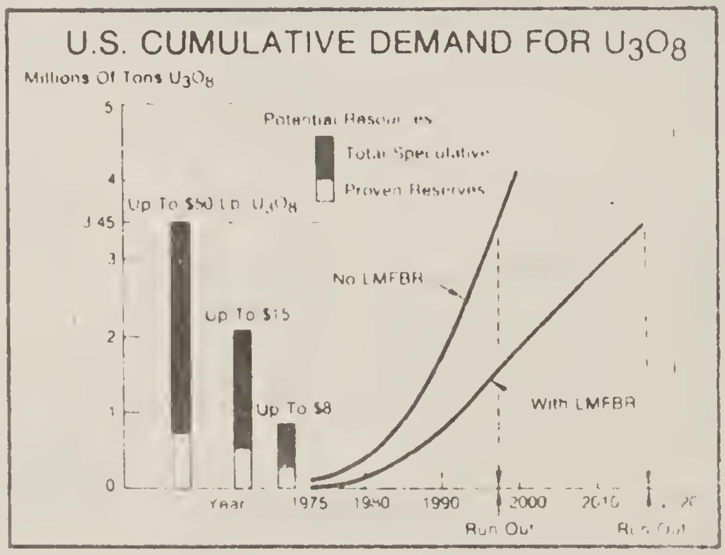
Electrical Substitution and Waste Heat

Although steam electric power plants discharge most of their waste heat to the aquatic environment, it is important to note that the ultimate heat sink is the earth's atmosphere. Concern over global temperature response to man's increasing waste heat additions is mounting. The total waste heat discharged in the generation of equal quantities of useful work are reduced for each case of electrical substitution for direct combustion of fossil fuels. The higher operating efficiency of the electric car results in a better than 50% reduction in total waste heat, compared to the gas-engine automobile. In process and space heating, electrical substitution produces substantial waste heat reductions as both the Templifier and heat pump actually remove heat from the outside environment during operation.

LIQUID METAL COOLED FAST BREEDER REACTOR (LMFBR)

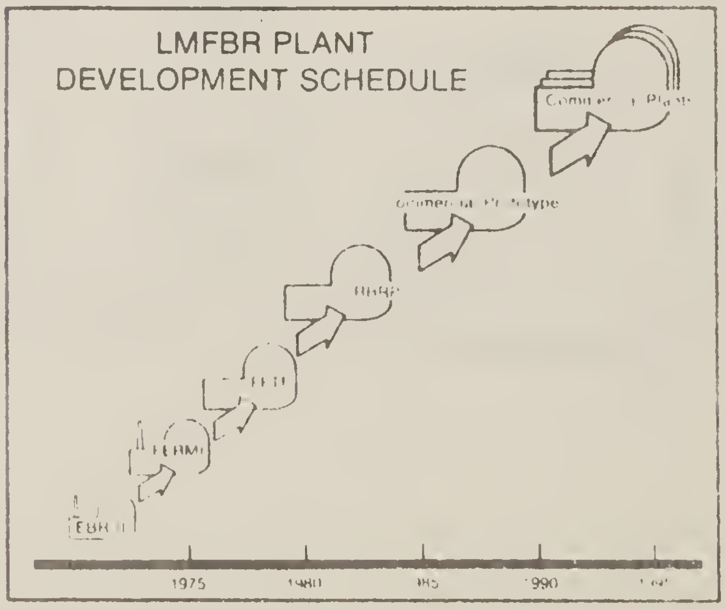
LMFBR is a reactor system that, while producing electricity, produces more fuel than it uses. It converts zero value by-products of the LWR (depleted uranium tails from enrichment plants) into fuel for future plants. LMFBR requires no mining or land disturbance for at least 100 years. The system has been adopted by the United Kingdom, France, USSR, Japan and West Germany.

LMFBR is Needed Because



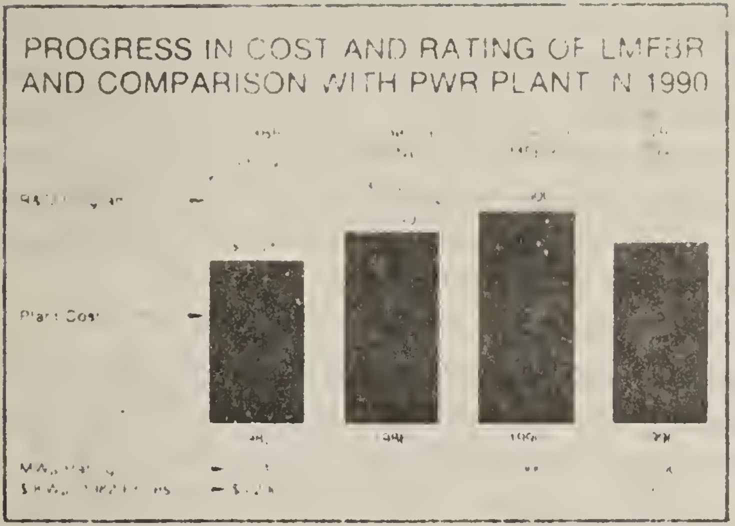
Known uranium reserves are 700,000 tons. Adding potential reserves gives a total of 3.45 million tons. Without the LMFBR, all known and potential reserves will be used by 1995. With LMFBR introduced in 1985 extends these reserves to 2015. More importantly, the spent fuel from the LWR's would provide fuel for the breeder reactors sufficient for supplying man's energy for centuries to come. Thus, it is imperative that the LMFBR be commercially available by the mid-1980's.

Commercialization of the LMFBR



Early U.S. plants were EBR-II and Fermi. They established scientific and technical feasibility. FFTF under construction will provide test capability, licensing basis, standards for manufacturing, quality control procedures, industrial manufacturing base. CRBRP 350 MWe demonstration plant provides design capability and basis for licensing commercial plants. 1500 MWe commercial prototype provides standard plant, establishes competitive bidding for components and utility confidence. Commercial plants 1500/2000 MWe operational in 1988.

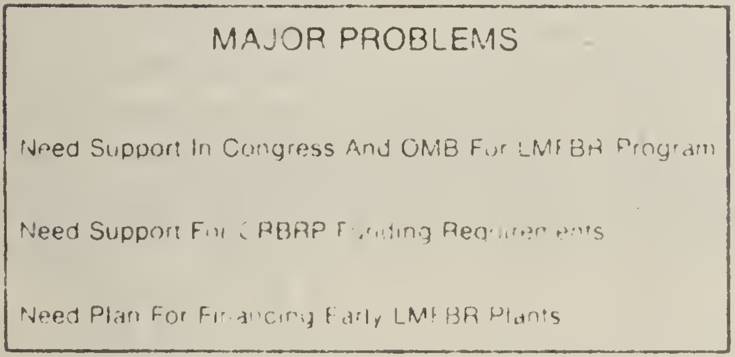
LMFBR, LWR Plant Costs


PROGRESS IN COST AND RATING OF LMFBR AND COMPARISON WITH PWR PLANT IN 1990

The 350 MWe demonstration plant has a total cost of $1.736 billion (in 1982 dollars) with a plant cost of $1.126 billion and $610 million charged to research and development. The total cost estimate has risen from $690 million in 1972 to $1.763 billion in 1974. The cost increase is due to increases in escalation, contingency and safety requirements. Such increase is small when compared with the Alaska pipeline which rose from an original $900 million to current estimates of $5.9 billion. Here too, escalation, contingency and safety requirements were primary causes.

By 1990 the plant cost will have risen to $1.5 billion which will be cost competitive with the LWR on a total power cost basis because of the fuel cycle cost advantage of the LMFBR.

Today's Major Problems


MAJOR PROBLEMS

Need Support In Congress And OMB For LMFBR Program

Need Support For CRBRP Funding Requirements

Need Plan For Financing Early LMFBR Plants

Must improve support of LMFBR in Congress. Need strong support in government agencies, particularly the Office of Management and Budget. Need federal support for financing and shared liability of commercial plants.

NUCLEAR SAFETY

To place the issue of nuclear safety in perspective, first look at the information now available from independent authoritative sources. Two very recent studies have been completed to quantify the risks associated with nuclear power plants. One was done in Sweden; the other at the Massachusetts Institute of Technology under the direction of Dr. Norman Rasmussen. The numerical results differ in detail but reach the same conclusion: even a very large number of nuclear power stations present a very small risk indeed--at least 100 times smaller than other risks to which society is constantly exposed.

Risk of Fatality by Various Causes

Causes	Individual Chance Per Year
Disease and Old Age	1 in 100
Motor Vehicle	1 in 4,000
Falls	1 in 10,000
Fires and Hot Substances	1 in 25,000
Drowning	1 in 30,000
Firearms	1 in 100,000
Air Travel	1 in 100,000
Falling Objects	1 in 160,000
Electrocution	1 in 160,000
Lightning	1 in 2,000,000
Tornadoes	1 in 2,500,000
Hurricanes	1 in 2,500,000
All Accidents	1 in 1,600
Nuclear Reactor Accidents - (100 Plants)	1 in 300,000,000

Specifically, the Rasmussen study shows that an individual living near a nuclear power plant has a fatality risk of one in 300,000,000--more than a hundred times less than that of being killed by a bolt of lightning. Dr. Rasmussen also calculated that for the worst nuclear accident which could be imagined, the number of fatalities would be less than for a major dam failure or an airplane crash in a crowded area.

As for the health hazard presented by such a nuclear accident, Rasmussen concluded it to be so small that genetic or medical effects could not be statistically measured. And in terms of property damage, the Rasmussen report indicated the average loss per nuclear plant per year, including postulated accidents with large damage potential and very low probability, would be about $10,000, exclusive of damage to the plant itself.

The Rasmussen study is a professional in-depth analysis by an independent highly competent group of technical experts. It involved a composite of technical judgement, detailed plant descriptions, quantified reactor safety evaluations, known component failure rates, and direct research and experimental measurements.

The risk analysis was concerned with examining in detail the worst of all conceivable nuclear power plant failures including the melting of the reactor core. The last is the worst of all possible accidents in a nuclear power generation system because that other apocalyptic event--a nuclear explosion--cannot take place in the generation of electricity for the simple reason that neither the material nor the conditions that make possible a nuclear explosion are present.

Why Nuclear Power is Safe

The nuclear chain reaction process, capable of generating large amounts of heat from the controlled fissioning of uranium, was first demonstrated in the early 1940's. In the 30 years since that time, substantial research effort by a number of nations has succeeded in developing this technology as a practical source of energy for the generation of electricity. Those efforts have been successful, and today there are a variety of nuclear power reactors available commercially that are capable of producing large amounts of electricity. In the United States, about 53 of these large plants are now operating, and during the next year, nuclear power plants will generate nearly 10 percent of our nation's electricity.

During the last 30 years, we have accumulated many hundreds of reactor years of experience with commercial and naval nuclear power reactors. At the outset, the potential dangers of radioactive materials were recognized and steps were taken in the design and operation of these facilities to assure public health and safety. In the operation of the United States commercial power program, no member of the public has ever been killed or injured from any reactor-related accident. Compared with other technologies, this is an almost unbelievable statistic and reflects the fact that no other technology and industry has ever been developed with as much attention to safety and environmental matters. This outstanding safety record has not been a matter of good fortune. It has resulted from painstaking efforts directed toward safety. Some key elements which provide confidence that nuclear plants are safe include:

- A design philosophy known throughout the industry as "Defense-in-Depth"

- The availability of such inherent safety features as self-limiting power control capabilities, multiple barriers to radioactivity release, and structures that maintain both structural and biological integrity

- [illegible] in-depth quality assurance program,
- Compliance with rigorous licensing requirements and scrutiny by numerous governmental agencies, and
- Maintaining the safe conduct of plant operation throughout the life of the plant.

Defense-in-Depth

The concept of the first level of defense can be stated: "Design for maximum safety in normal operation and maximize the ability of the system to tolerate malfunctions". Simplified, the philosophy is to assure a high degree of reliability and accident prevention in the operation of the plant through the intrinsic features of sound and conservative design, construction, testing, and operation. Some specific examples of first-level considerations include the selection of fuel, coolant, and core structural materials which have inherent stability and safety characteristics, and selection and use of structural materials whose physical properties are well known. In summary, the first level of defense requires that the plant be soundly and conservatively designed, constructed, tested, operated, and maintained in accordance with very high quality standards and engineering practices.

The concept of the second level of defense is based upon the fact that, in spite of care in design, construction, and operation, it is prudent to anticipate that some incidents will occur during the service life of a nuclear plant. For this reason, nuclear plants are equipped with reliable, conservatively designed devices and systems which provide a second level of safety to protect the operating staff, the public, and the plant by assuring that such incidents will be prevented, arrested, or accommodated safely. One of the important systems of the second level of defense is the fast-acting reactor shutdown system activated by redundant and independent instrument channels which monitor diverse plant parameters and translate their respective input signals through redundant logic channels to terminate the fission process.

The third level of defense may be stated as follows: "Provide additional safety systems as appropriate, designed to add even further margin by postulating for design purposes the occurrence of extremely unlikely circumstances." One of the incredible design basis accidents which the plant is required to accommodate safely is based upon the assumption that the largest cooling pipe (a 3-inch thick wall, 29-inch diameter pipe) breaks instantaneously and is displaced such that there is a rapid loss of coolant from both ends of the broken pipe. Realistically, there is no credible mechanism that could cause such a physical displacement of this pipe. In fact, fracture mechanics tests and analyses indicate that a defect in the pipe would result in leakage long before any failure would occur. This would be detected by the second level of defense leak detection system, permitting corrective measures to be taken before any serious safety problem could develop. From an analysis of such postulated events, we design and incorporate into the plant the third level of features and equipment to safely control the situation and protect the public health and safety.

For example, the systems and components which mitigate the consequences of the design basis accident described include the emergency core cooling system (ECCS), which removes the stored energy and fission product decay heat from the reactor core and limits possible core damage, the containment heat removal system which assures that the energy released to the containment is removed and the containment pressure transient is constrained below its peak design value, the redundant electric hydrogen recombiners that maintain safe hydrogen concentrations resulting from metal-water reactions, corrosion, or radiolysis, and the emergency boration system which provides sufficient boric acid solution--a good neutron absorber--to accomplish a safe reactor shutdown.

A frequent misunderstanding about nuclear power is the idea that these third level systems and defenses their respective input signals through redundant logic channels to terminate the fission process.

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A frequent misunderstanding about nuclear power is the idea that these third level systems and defenses are the primary or sole reason why the industry claims the plants are safe and that they really expect the things to happen which the third level is designed to guard against. The accidents which are postulated at the third level, including the design basis loss of coolant accident, are remote and can only result if the first level and the second level of defense fail. Thus, the accident postulated for the third level of defense is never expected to occur. In taking this approach and designing for accidents which are not expected to happen, the nuclear industry is vulnerable to a critic who selects the postulated hypothetical accident and discards the premise on which it was based, thereby portraying an image to the public that the designers really contemplate failure of the system.

Extremely Low Risk from Nuclear Power

The 14-volume Rasmussen report entitled, "Reactor Safety Study: An Assessment of Accident Risks in U.S. Commercial Nuclear Power Plants" (WASH-1400 August 20, 1974) predicted that the probability of a core melt accident with 100 or more fatalities is about one in one million, or for 1,000 or more fatalities, about one in one hundred million. The largest calculated value was 2,300 fatalities with a probability of about one in a billion.

These probabilities should be compared with the fatality risks to which most people are exposed such as motor vehicle--one in 4,000; drowning--one in 30,000; lightning--one in two million. The study noted that the probability of a core melt accident with 1,000 or more fatalities of one in one million, or once in a million years, is about the same probability of a meteor striking a U.S. population center and causing 1,000 fatalities. Thus, the Rasmussen report clearly demonstrates that the risks associated with nuclear power are very small.

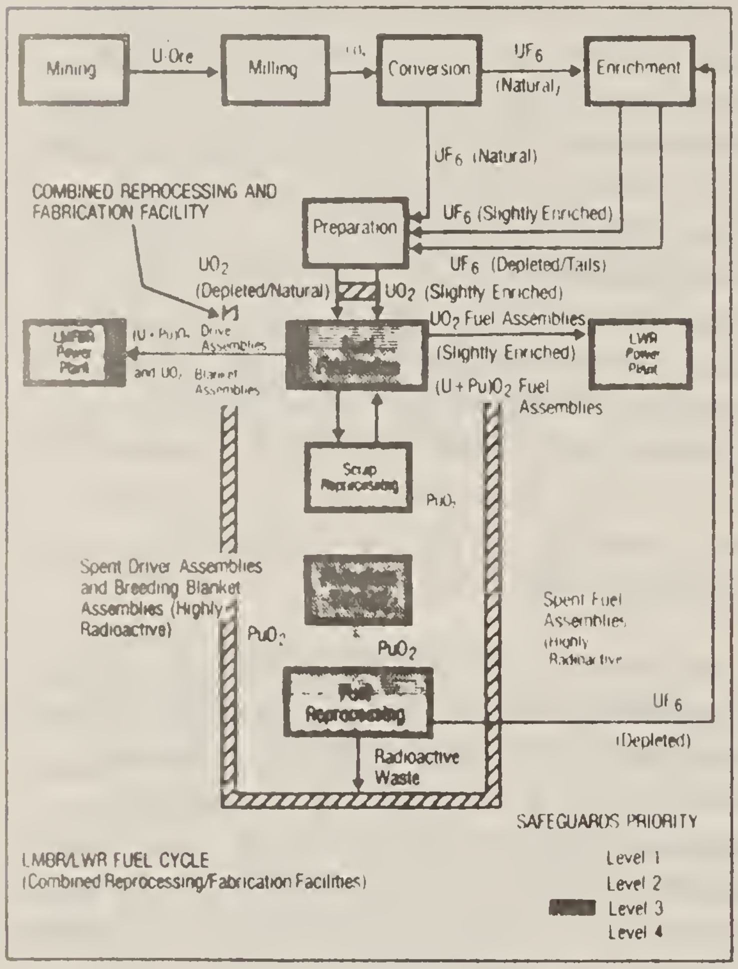
Waste Management

The final requirement for nuclear facilities in the Electric Energy Economy is to provide for management of the radioactive waste produced during reactor operation, fuel reprocessing or fuel fabrication. This requirement is facilitated by the small volumes of high-level wastes which will be involved. Low-level wastes, while significantly more voluminous, pose no real environmental problem due to their low levels of radioactivity. When solidified, the total volume of high-level waste to be generated through the remainder of this century is less than 500,000 cubic feet. If not for the contained radioactive decay heat, this quantity of waste could be stored in a one-story building 200 feet on a side.

The AEC currently plans to store these high-level wastes, under surveillance, in the Retrievable Surface Storage Facility (RSSF). Three different concepts, any one of which would be satisfactory for storage, are currently being evaluated for the RSSF: the water basin concept, the air-cooled vault concept, and the sealed cask concept. An expeditious decision is needed on the selection of one of these alternatives for the RSSF. The amount of land necessary to store all the high-level wastes shipped to the AEC by the year 2010 will be between 30 and 1,100 acres, depending on the concept chosen. A 1000 MWe nuclear reactor produces about a ton of radioactive fission products per year. The waste produced in one year from one such plant can be stored in about 10 sealed stainless steel canisters each a foot in diameter and 10 feet long and containing 6 cubic feet of solidified waste.

Site selection need not be limited to any one particular region of the country and several sites located in various geographical regions of this country can meet the anticipated demands of the nuclear industry.

The AEC is also currently investigating methods of waste disposal which will not require surveillance, but regardless of the outcome of these investigations, the RSSF presents a safe method for storage of all the wastes generated through the use of nuclear power.



Diversion of Nuclear Fuel

This figure provides a fuel cycle flow diagram for both breeder (LMFBR) and light water (LWR) reactors. It is coded to highlight four levels of safeguards concern involving plutonium materials in the fuel cycle. Level 1 indicates the sites and transportation links involving plutonium oxide powder, the plutonium form most valuable for diversion (no metallic plutonium is anticipated). Level 2 indicates the presence of plutonium nitrate or mixed plutonium-uranium oxides which require chemical processing to obtain plutonium. Level 3 indicates unirradiated, hence only slightly radioactive (1R/hr at contact) mixed oxide fuel assemblies, and Level 4 indicates the presence of a low concentration of plutonium, or plutonium in a highly radioactive (30 inches of steel required for shielding) form which would minimize the desirability of theft.

Present AEC regulations for safeguarding plutonium and other special nuclear materials, as modified by recently adopted and proposed amendments, provide adequate protection against diversion. As the use of plutonium increases in the future, some additional improvements in safeguards may be desirable. Carl Walske, president of the Atomic Industrial Forum (AIF), recently proposed ten points for strengthening safeguards which are felt to be generally acceptable to the nuclear industry. One of the most important of Walske's points was the recommendation that guards accompanying special nuclear materials in transit should be under government control and orders, either as government employes or under government contract.

U.S. GOVERNMENT POLICY AND ACTIONS REQUIRED TO IMPLEMENT THE ELECTRIC ENERGY ECONOMY

1. GENERAL

1.1 Adopt a national energy policy which identifies as its central strategy:

- the maximum use of electricity generated from nuclear fuel and coal;
- the substitution of electricity for oil and gas wherever technically feasible; and
- adjusting and administering all policy, law and regulation, tax incentives and R&D to conform to this central strategy.

1.2 Remove restrictions on promotion of electricity where it encourages substitution or conservation.

1.3 Provide tax incentives and mandate new rate structures which, combined, encourage the conservation of energy, substitution of electricity for oil and gas, and off-peak use of electricity.

1.4 Encourage States to assure financial viability of electric utility industry by getting rates up to levels sufficient to provide allowable returns on investment and without the regulatory lag currently experienced in most States.

1.5 Increase investment credit for utilities to 10%.

1.6 Provide a 60-month writeoff for electric utilities for all investments in new facilities, including buildings.

1.7 Provide for interest paid on long-term debt obligations of electric utilities to be tax-free to recipients.

1.8 Allow an income tax credit, rather than a tax deduction, for qualified research and development expenses associated with the development of alternative energy sources.

1.9 Mandate the elimination of various local taxes and levies on utility sales.

2. GENERATION OF ELECTRICITY

2.1 Mandate, beginning immediately, phasing out gas and oil for base load electric generation, allowing for continuing use of gas and oil for intermediate and/or peaking on an approved basis only. Schedules for phasing out or any continued use to be developed by FEA with each Reliability Council and then mandated.

2.2 Reduce construction time for nuclear plants from ten to six years. The key strategy to achieve a six-year cycle is to replace the current series process (licensing followed by construction) with a process in which both licensing and construction are pursued in parallel.

2.3 Create national policies to resolve nuclear fuel enrichment, transportation and storage problems.

2.4 Adopt a national policy that guarantees postponement of implementation of the complete Clean Air Act until economically feasible coal cleaning systems are developed.

2.5 Eliminate thermal discharge regulations.

2.6 Increase uranium depletion allowance (22%) to 27.5 and liberalize deductibility of exploration expenditures.

2.7 Increase support of development of the LMFBR.

2.8 Provide financial support and shared liability of commercial LMFBR plants.

3. RESIDENTIAL AND COMMERCIAL ENERGY USE

3.1a Prohibit use of gas and oil in new construction beginning in 1978.

3.1b Restrict FHA and VA mortgages for new housing to those with electric heating and cooling systems.

3.1c Mandate revision of building codes; require computerized study of energy use alternatives to assure compatibility with national policy.

3.1d Provide tax incentives for buildings designed to minimize use of energy, and to maximize use of electricity.

3.1e Executive mandate that all new Federal facilities use electricity for heating and cooling.

3.2 Allow use of gas and oil in replacements on a special permit basis only.

3.3a Establish Federal minimum standards for heat pumps.

3.3b Require utility company supervision in installation of heat pumps.

3.3c Prohibit new central air conditioning installations except by heat pumps.

3.4 Sponsor research and education on thermal storage systems.

3.5 Sponsor nationwide educational program for consumers, architects, building owners and builders re efficient design and use of systems for electricity use and conservation.

4. TRANSPORTATION ENERGY USE

4.1 Mandate that all new purchases of U.S. Government-owned passenger and service vehicles for urban use be electric starting in [illegible].

4.2a Increase Federal tax on gasoline.

4.2b Use increased tax revenues for creating electrified rapid transit systems and for subsidies for free urban transit systems.

4.3 Encourage use of car pools and buses by creating exclusive traffic lanes.

4.4 Sponsor research on new types of batteries, electric vehicle control and propulsion systems.

4.5 Sponsor research, development and demonstration projects for:

. dual-mode vehicles

. automated rapid transit

. urban "horizontal elevator" systems.

5. INDUSTRIAL ENERGY USE

5.1 Encourage substitution coincident with encouragement of conservation. A Government-sponsored series of seminars throughout the country should be used to provide detailed application information on the latest available products and systems. Seminars should be separated into major types of industries.

5.2 Create an authority to study and approve any new applications for oil or gas. Approvals will be subject to special taxes on the use of gas and oil where substitution of electricity is deemed possible.

5.3 Retrofit military bases for maximum use of electricity and minimum use of oil and gas.

5.4 Sponsor:

- a study program aimed at identifying how gas and oil are used in each industry, what electric substitutions are now possible, and what new electrical devices need research and development, and
- research into the myriad of electric devices that will be needed to maximize electric substitution.

5.5 Provide a 60-month writeoff for new investments in productive facilities made by manufacturers of electric energy-producing, transporting, or consuming equipment.

5.6 Increase investment tax credit from 7% to 10% for such new investments in electric energy oriented facilities. The full investment tax credit for such investments would be permitted without regard to the shortened depreciable life.

HEARINGS EXAMINER: Mr. Crosby, you appear here as a proponent; isn't that correct?

WITNESS: Yes.

HEARINGS EXAMINER: Very well, Mr. Shenker, you may cross-examine.

WITNESS: Before he does that, could I just say a few words.

HEARINGS EXAMINER: You certainly can.

Oral Supplement to Written Statement

By Rulon Crosby:

WITNESS: Okay, I'm a sales engineer for Westinghouse in Butte. Westinghouse has a commercial interest in saying that 3 and 4 are built. However, I'm not testifying on behalf of the Westinghouse Corporation, nor on behalf of Montana Power, nor to I purport that everything that I say or all the conclusions that I draw from whatever data I've used would necessarily be approved of by those two companies. I hope so, but I have not been able to ascertain that for a sure fact, nor have I really endeavored to, for that matter. A good part of the data, information, that my testimony was based on is filed away in Pittsburgh and Butte, and I'm not sure how well my memory will permit me to recall all this, but I'll do the best I can from memory, and if the board or anyone else would like additional data, I'll try to do my best to provide it subsequently. Finally, the primary point I was trying to make, and am trying to make, and hope, indeed, is communicated to the board through my testimony is that I believe we need to pay attention to one fact, perhaps to a little greater extent than has been previously in the hearings, and that is that even if the total demand for energy in this country did not go up, as, indeed, it is likely to; still there would be in my opinion an increased demand for electricity because of the substitution of electricity for other forms of energy that are going to be in increasingly short supply. Therefore, I strove to introduce some material here that would support this intention, both on a national and state level. That's all I have in regard to my opening statement, and if there are any questions that I can answer, I'm ready to do so.

HEARINGS EXAMINER: Are there any questions?

EXAMINATION OF RULON CROSBY

Cross, by Department of Natural Resources and Conservation

By Mr. Shenker:

Q That's why we're here, Mr. Crosby. Your statement consists, as I understand it, of a letter of Feburary 17, 1976, to Mr. Davis to which is attached a piece of paper on which there are a couple of graphs, and you make reference in your letter to a statement which you say you authored and another statement which you say was the testimony given by a Mr. Simpson of the Westinghouse Corporation?

A I think I said it was taken largely from testimony by Mr.

Simpson, yes.

Q On the front of that document it says Report number PSP 3-21-75, R. L. Dunning, and gives a telephone number. Now I called that telephone number, I must say, this morning, and nobody was in; but who's Mr. Dunning?

A Mr. Dunning was the gentlemen who compiled Mr. Simpson's testimony and some other exhibits into this report.

Q Oh, okay.

A Mr. Dunning, by the way, no longer works for the Westinghouse Corporation, and that's probably the reason you were unable to get him at that phone number.

Q I see. Is that a general Westinghouse number where lots of folks can be gotten?

A No, that was the number of his office in Pittsburgh at the time he worked for them.

Q Okay, well, let's talk about you first, and then we'll get to the statement of Mr. Dunning or Mr. Simpson or whoever it is. You are a power systems sales representative?

A Yes.

Q Yes, that means you sell power systems?

A Power systems equipment.

Q Such as turbines and boilers?

A Generators, transformers, and meters.

Q Yes.

A Wait a minute; boilers I don't sell, but that is a power system piece of apparatus, of course.

Q Is the Westinghouse Corporation that you represent supplying a piece of equipment for the Colstrip units?

A Well, we help supply a lot of equipment for the Colstrip units.

Q Are you supplying any now?

A Colstrips 1 and 2 you mean?

Q Yes, sir.

A Yes, we are supplying some equipment for Colstrip 1 and 2; not as much as we'd like, however.

Q And you're bidding on contracts for 3 and 4 should they be certified?

A Indeed.

Q Okay. Did you do any business with the Montana Power Company with the Corette station?

A Oh, yes, indeed, we did.

Q Would you like to continue your business relationship with the Montana Power Company?

A We would be very desirous of doing so.

Q And would the same thing be true with respect to the Portland General Electric Company, the Pacific Power and Light Company, the Washington Water Power Company, and the Puget Sound Power and Light Company?

A All those plus several utilities that you have not yet listed.

Q Okay. That's your business and, in particular, that's your specific business because you want to sell, right?

A Indeed it is.

Q Okay. Now in your statement, Mr. Crosby, you don't tell us what your background is. Could you tell us for the record what your academic background is first?

A Oh, yes. Yes, I believe I'm the only power systems sales representative with Westinghouse that has a history degree.

Q A history degree?

A Yes, indeed.

Q Splendid. History of power systems?

A Well, no, no; it was rather more generalized than that.

Q Where did you go to school?

A The University of Wyoming.

Q Yes, having graduated from Wyoming with a history degree, did you directly go into the utility equipment supplying business, or did you have some other business background before that?

A Well, I had some other background before that.

Q Good; what was it?

A Well, let's see. Amongst other things I fished for salmon in Alaska, I worked on construction, I worked for a swiss architect engineering firm, and, as far as Westinghouse is concerned, I spent my first years with Westinghouse not selling power apparatus but building, or working in the construction of a nuclear power plant and later on working also in the nuclear division in Pittsburgh and also in the environmental systems division in Pittsburgh for awhile before taking the position in Butte which led to my being responsible for the selling of power systems apparatus.

Q When did you take that position in Butte?

A Three years ago.

Q Did you have any contact while you were at the Westinghouse environmental systems division with Mr. Wright or Mr. Voytko?

A Oh, indeed I did, yes. Mr. Wright was the man that I worked for, and Mr. Voytko was one of my colleagues.

Q You wouldn't by any chance have had any contact with the environmental analysis that was prepared by the Westinghouse environmental systems department for the Colstrip project management, would you?

A Well, I've had contact with it. However, I switched jobs and left the environmental group before the contract was assigned to do this so I was not directly involved with this effort, no.

Q Didn't you help any of the folks in Pittsburgh to gather information and make arrangements for them so that they could do their work better?

A I found some motel accommodations for several when they came to this area, but no, I didn't participate directly in the gathering of information for this study.

Q Do you know Carl Anderson?

A Yes, I do.

Q He's with the Montana Power Company and he's their environmental man?

A That's true.

Q And he also participated in getting motel accommodations for the folks from Westinghouse?

A We try to be accommodating.

Q Well, did the two of you do it together in tandem team?

A No, not often in tandem.

Q Had you had any other sales background before you became a power systems sales representative?

A Well, there was a period when I was going to school that I financed certain portions of my education with selling what we chose to call cookware; others might call it pots and pans.

Q Never sold encyclopedias?

A No, never did sell encyclopedias -- snake oil.

Q Used cars?

A Or used cars.

Q Insurance?

A No.

Q Okay. Have you ever engaged in the preparation of load forecasts?

A I have somewhat, yes.

Q Oh, good; for whom?

A For whom?

Q Yes.

A Well, specifically, let's see, we could cite perhaps the Northern States Power in Minneapolis.

Q When did you do that?

A While working with the environmental systems department. Oh, and I thought of another one, NIPSCO, Northern Indiana Public Service Company. But there again I was doing this as just part of a study team.

Q You mean the Westinghouse environmental systems department was invited in to prepare an environmental analysis for the Indiana utility and for the Minnesota utility in order to assist them in applications they were making for permits?

A Yes.

Q And as part of that application, of course, they'd have to say something about what their demand projections were, and your environmental analysis would have to address that, too?

A Indeed.

Q Okay. Other than that, have you been involved in putting together demand forecasts for utilities directly?

A No.

Q Have you been engaged in compiling data for resource analyses?

A For resources analyses?

Q Yes, sir.

A On my own to a certain extent, yes.

Q Oh, good. What resource analyses have you made for Montana Power Company?

A For Montana Power Company? I have made none for Montana Power Company.

Q Have you made any resource analyses for any of the other four applicants in the Colstrip project?

A No, I haven't.

Q For whom have you made resource analyses?

A For myself.

Q For your own personal resources you mean?

A No, I made the analyses of other people's resources for my own satisfaction.

Q I really had in mind, Mr. Crosby, resources of energy that could be utilized for the delivery to users of energy. Now within that context, have you engaged in resource analysis work?

A You have, of course, before you an example of the kind of resource analysis I have engaged in. That's about the sum extent of it right there.

Q Okay, we'll get to that to some extent then. Let's take a look first at your letter of February 17, 1976, in the third paragraph, where you state that as the economy recovers from the recession, as it is beginning to do now, demand for energy will grow even more rapidly than the historic 4 percent per year trend?

A Yes.

Q Whose history is the 4 percent per year trend?

A Whose history?

Q Yes.

A That's the history of energy growth in the United States, and that's the trend line that's identified on the graph on the next page.

Q Okay. In the paragraph just above that one, you refer to those charts on the second page of your letter of February 17, and you refer there to the growth and decline of energy usage in the United States. By energy usage you do mean all forms of energy, do you not?

A Yes.

Q And do you have some idea, Mr. Crosby, of what part of the energy growth which is represented in the trend lines on the second page of your letter is petroleum?

A About 80 percent; petroleum and natural gas will stay together.

Q Just as sort of a preview of coming attractions, we'll get into the testimony prepared by Mr. Dunning for Mr. Simpson, but you refer to it in the third page of your letter which is actually labeled page 2 because of the insertion of the graph between the two pages of the letter, and you say that that document was taken largely from the testimony delivered by J. W. Simpson. Where else was it taken from?

A From other research work done by Mr. Dunning and his team.

Q Is Mr. Dunning with the environmental systems department of Westinghouse?

A No.

Q What's his job with Westinghouse?

A Well, as I indicated earlier, Mr. Dunning is no longer employed by Westinghouse; however, at the time that he compiled this report, he headed up an energy utilization office at Westinghouse whose specific charter it was to try to learn as much about energy trends as possible and forecast them with respect to their effect on electrical demand and, of course, upon the demand for power systems products.

Q That wouldn't have anything to do with Westinghouse's interest in selling the components for those demands, would it?

A A peripheral interest, perhaps.

Q But it's largely an academic exercise on Mr. Dunning's part you would think?

A It was an exercise to try to help Westinghouse and its customers decide what sort of decisions they ought to make in regard to energy utilization and energy planning.

Q I notice in the copy that I have of Mr. Dunning's statement prepared for Mr. Simpson that some of the pages are inverted, that is to say, they are upside down. There's no significance to that, I assume?

A The only significance there is that I was on a trip away from the city when this was put together, and I apologize on behalf of my secretary if she's gotten any upside down.

Q Okay. Now as I read generally Mr. Dunning's statement and your own, for that matter, Mr. Crosby, it seems to me that the thrust of your position is that one really ought to pay very close attention to the maximum efficiency in utilization of energy for delivery to consumers; isn't that correct?

A That is certainly a part of it.

Q And in your letter on page 2, at the end of the first paragraph, you believe that the Board of Natural Resources in this proceeding will be setting a precedent on the issue of how western coal will be used to help solve the national energy crisis, right?

A That's what I wrote.

Q Can you tell me why you did not address yourself in your own statement, nor did you provide for us from Mr. Dunning, Mr. Simpson, or anybody else from Westinghouse, a comparison of the utilization of coal to send to load centers, and the utilization of coal to generate at mine-mouth?

A Well, where, of course, the power is generated does not affect the demand for it, and that's what we were talking about here, whether it's to be generated at mine-mouth or a thousand miles away from mine-mouth.

Q Well, it certainly does affect, does it not, the utilization by efficiency?

A Oh, indeed it does, yes.

Q Yes, and in view of the efficiency affect, whether you are delivering to consumers or users at a load center from a generating station there, or delivering to consumers off of a thousand miles of transmission lines from a mine-mouth generating station, why in that case did you not compare those circumstances for us?

A It was not the specific intent of my testimony to get into that particular issue; however, it is true that it's my opinion, and I believe probably the opinion of Mr. Dunning and Mr. Simpson, that the most efficient possible choice should be made in regards to whether to ship the energy in the form of kilowatts or in the form of coal.

Q Now you make the statement in your letter, in the next to the last paragraph, that Montana will soon need all the energy the Colstrip 3 and 4 plants will be able to generate; you understand that energy to be 1,400 megawatts less whatever is lost at the generating station?

A I do understand that.

Q Okay. When do you think Montana will need an additional 1,400 megawatts of energy?

A An additional 1,400 megawatts? It needs a good fraction of that 1,400 megawatts now.

Q Well, it has energy available to meet what it now has by way of demand in Montana; isn't that true?

A The demand for energy in Montana seems to be being met, yes.

Q Yes, so let's look at 1,400 megawatts as additional demand; when do you think that that additional demand would be generated?

A Will be generated?

Q Yes, produced.

A Oh, the demand will be generated, not the kilowatts?

Q Yes.

A That is something I could not put a precise schedule on. It depends very much, for example, on what the Canadians might do in cutting off supplies of natural gas to Montana; it depends upon what success is achieved in finding other alternative sources of energy. However, as I point out in one part of my testimony there, I don't believe that we can afford to gamble on these other resources becoming available, so I thought it prudent that we begin now to look for ways to supply this demand.

Q Are you aware of the rule of thumb of 72 with respect to doubling?

A The rule of thumb of 72?

Q Yes.

A Are you talking about the doubling demand every 7 years, or every 10 years?

Q Yes.

A I'm aware of it.

Q Seventy-two is kind of a handy number because it means that if you have 6 percent growth, that doubles every 12 years, if you have 7.2 percent growth, that doubles every 10 years, and if you have 4 percent growth, then that would be doubling in the neighborhood of every 18 years, right?

A I believe that's approximately right; I haven't checked your mathematics, but I'll take your word for it.

Q Now if you look at 4 percent growth, Mr. Crosby, as you did in your letter, and you doubled in 18 years as a result of such a growth rate, how much additional energy would that be by way of demand in Montana?

A Well, of course, I was referring to total energy, and I don't have sufficient data as to what Montana's total energy demand is at this time to answer your question.

Q I see. Would you expect that the Montana Power Company would take into consideration the factors which you have presented in your testimony on the need for conversion from natural gas to electricity as they make their demand projections?

A Well, I'm sure that Montana Power will and has to a certain extent; however, I have noted that a good deal of the information in regard to the potential shortage of natural gas as a consequence of Canadian actions has actually become available since the application for the Colstrip project was put in.

Q Would it help you to know that the Montana Power Company and the other four applicants in this proceeding have engaged in revising the additions of their projections during the course of this proceeding, most recently in January of 1976?

A Well, I'm sure it would be a prudent thing for them to do to take cognizance of events that occur while in the process of hearings.

Q Sure. And with such recent revisions you would expect them to take into consideration the desirability, necessity, feasibility, and practicality of conversion from natural gas to electricity; wouldn't you?

A Well, I would probably expect that, but I guess I'm beginning to wonder what my expectations in regard to Montana Power

Company's actions has to do specifically with my testimony here.

Q Oh, we'll get to that, Mr. Crosby.

A Well, okay.

Q Now if the five applicants in this proceeding were to take a look at the suggestion you have made as to growth and were to project the need for all of Colstrip units 3 and 4 in Montana soon, don't you think that should be reflected in their own projections?

A Perhaps it has been discussed by these people.

Q If it had not been discussed by them, would that give you some pause in your own projections, or would you think they were just making a little mistake?

A Well, now, Mr. Shenker, you see you're putting me in a position here where I might have to say that my guesses would be better than my customers, and I hate to do that.

Q Well, you don't want to say that?

A No, as a matter of fact, I don't; but despite the fact that I wouldn't want to say that, certainly there is room for a difference of opinion between myself and my customers, if, indeed, these do exist. However, I have not questioned the Montana Power Company or its partners specifically on this point. It could be that they agree with everything I say, and on the other hand, it could be that there might be some minor differences. However, if you would like to inquire, I suggest that you call some of these peoples' witnesses.

Q Well, that's very helpful of you, Mr. Crosby.

A Always glad to help.

Q I wish I'd thought of that, but that's really a very good suggestion. Let me ask you this, sir. In the course of your contact with the Montana Power Company and others, do you sometimes suggest to them that their perceived needs are not as great as you would think they should be perceived?

A I sometimes suggest that very diplomatically.

Q Yes, indeed; that is to say if you could sell two turbines instead of one in the same period of time, your track record would look better; wouldn't it?

A As a Westinghouse salesman, indeed it would.

Q Yes. All right, let's take a look now, Mr. Crosby, at the document which you have prepared along with your letter of February 17, which is stated, "solution to natural gas crisis, coal gasification or electricity"?

A You like that title?

Q I assume you thought that one all by yourself?

A Yes, as a matter of fact, rather quickly, however; I think we could have done better, but I think it will suffice.

Q I was a little disappointed; I thought that from the context of this statement that a better title would have been the solution; but it's modest, I suppose, to leave out the article the?

A Well, a solution might not have been bad either.

Q Okay. When did you prepare that document?

A When?

Q Yes.

A Oh, its preparation took place mostly I would guess in the months of August and September of 1975.

Q When did you put it to final print?

A To final print? I'm not sure it really has been put to final print, I've revised it so many times.

Q Yes, I've noticed it appears to be typed on different typewriters on some of the pages in the type script.

A Yes, indeed; that's a consequence of the fact that it has, indeed, been revised so many times.

Q Yes.

A I'm going to talk with my secretary about that, however.

Q Have you consulted with anyone other than your secretary for revising this statement from time to time?

A Yes.

Q Who?

A Well, I've tried to gather other information as it becomes available; for example, I talked with some people at the Montana Power Company about how things were proceeding in 1975 with regard to natural gas supplies, what they've been able to find and what they've been able to produce, and modified that chart somewhat from the first one that I produced.

Q Okay, that's Montana Power Company on natural gas; who did you talk to there, Bill Coldiron?

A Among others.

Q Who else did you talk to at the Montana Power Company to take a look at your views?

A Bill Sherwood was a considerable help in this particular regard.

Q He's in the engineering department?

A Marketing department.

Q Yes, anybody else?

A Oh, yes, but you see as a consequence of my job, I find myself talking to these people on pretty much of a daily basis, and I probably have talked to any number of them about this. Not all of them have much to contribute.

Q How about Roger Hofacker; did you talk to him?

A Very little about this, as a matter of fact.

Q Bob Labrie?

A Very little.

Q Don Gregg?

A Very little.

Q Don Olson?

A Don Olson? Also not too terribly much about this.

Q Dick Davenport?

A Dick Davenport? No, not so much Dick Davenport.

Q Rob Stuart?

A I don't even know Rob Stuart.

Q Dan Berube?

A I know Dan; I've talked to Dan a little bit about it, but he wasn't one of the primary sources of information for this.

Q Well, who are the primary sources of information, other than the ones you've already given me, or are those the primaries you've given me?

A Well, in regard, as I said, to gas supplies and electrical rates, Bill Sherwood was the most helpful gentleman in the bunch, and as I have had considerable conversation with Bill Coldiron about this, and I might say that Mr. Coldiron did not necessarily always agree with my interpretation of the facts presented here. Mr. Madison, Pete Madison of the gas department, was also quite helpful. I presented a copy to Mr. McElwain, president of the company, for his evaluation.

Q Did Joe smile when he had a chance to read your document, or did he frown?

A I wasn't there when he read it.

Q Did he respond after you gave him a copy for his evaluation?

A He thanked me.

Q He didn't suggest that you want to go back to the drawing table and consider with pause whether you come to testify as a public witness?

A No, as a matter of fact, I don't even know if he was aware that I was planning to testify as a public witness.

Q Be assured.

A Be assured? Okay.

Q Now let's take a look at page 3 of the document which you prepared in the process you have just described?

A Yes, okay, let's take a look at it.

Q Mr. Crosby, under the heading,"what are the available alternatives"?

A Yes, the article the is prominent there, go ahead.

Q Yes. You say that some large industrial users will be able to substitute direct burning of coal for natural gas. I assume you're referring to Montana; is that correct?

A Yes.

Q Which ones?

A Which ones will be able to?

Q Yes, sir.

A Oh, I believe I refer here later on to a couple of cement plants that will be able to, and, indeed, my last information we're in the process of converting.

Q How many megawatts are they going to generate themselves?

A How many megawatts are they going to generate?

Q Yes.

A I don't believe they're planning to use the coal to generate electricity; I believe they're planning to use it to heat their kilns.

Q Do you know of no industrial users of electricity or natural gas in Montana who are not now planning to install self-generating capacity?

A Do I know of some who are not now planning to?

Q No, is it your testimony that there are none who are now planning to install self-generating capacity?

A No, that's not my testimony.

Q Okay. Which ones are?

A Are planning to install self-generating capacity? I don't know.

Q Well, have you seen any studies on the capacity available to industries to self-generate?

A Self-generate?

Q Electricity, Mr. Crosby.

A Yes. I have not seen any studies directed toward an examination of the possibilities for various industries in the state of Montana to generate their own electrical power.

Q Have you seen any studies at all any place in the world that discussed the capacity of industries to generate their own electrical power?

A I believe I have seen such studies, yes.

Q Good. What do they show?

A It shows that some industries could serve themselves pretty well in this regard, and it would be impractical and uneconomic for others to do so.

Q Are you familiar with the study done by the Dow Chemical Company under the national science foundation grant which has been marked for identification as DNR Exhibit number 28 to this proceeding?

A I don't recall having seen the specific study; I am aware of some joint efforts that Dow Chemical has made with a power company in Michigan to have a joint nuclear plant; but that's the extent of my knowledge in regards to Dow's plans there. Oh, I'll take that back. I do have some other knowledge in regards to Dow's plans, however, not derived from that document that you just mentioned.

Q Well, do you have some idea of the amount of megawattage available in the pulp and paper wood products industry, just in the Montana general area?

A You're asking me if I know how many megawatts are generated by pulp and paper mills?

Q No, can be generated, the capacity for the pulp and paper industry in this area to generate electrical energy for what they are doing right now?

A No, I don't know how much unused capacity there might be in the pulp and paper industry.

Q Or any other industry?

A I doubt if there are very many industries that have very extensive ability to generate their own kilowatts, Mr. Shenker.

Q Would you believe 10,000,000 kilowatts in the United States?

A Would I believe it?

Q Yes.

A Well, if it were documented, I suppose I might.

Q Would you believe 710,000 kilowatts in the Montana area alone?

A Well, again with the same condition attached, I suppose I might. I presume we're working up to the relevance of all this?

Q Oh, I think it's already fairly relevant to those who will be reading this record, Mr. Crosby, and your incredulity with respect to the relevance is also of interest to us. In your statement on page 3, that is your document that's gone though all the revisions, in that same paragraph, "what are the available alternatives," you do point out that for large industrial users to be able to substitute direct burning of coal for natural gas will require sophisticated boilers and pollution control equipment. Does Westinghouse build those sophisticated boilers?

A No.

Q Why not?

A I'll ask the board of directors next time I have a chance to.

Q It seems like a good job, doesn't it?

A Well, we have a number of competitors in the business who are doing rather well. I don't know whether we would be able to compete very well with them or not.

Q Do you know what Babcock and Wilcox is doing with those boilers these days?

A With those boilers?

Q Yes, that's to utilize surplus steam capacity in industrial processes for self-generation?

A I am aware that Babcock and Wilcox is building boilers for a variety of purposes, including burning trash to produce steam for kilowatts.

Q Yes, and they make boilers for that purpose, don't they?

A I would suppose that they would, but here again I don't represent myself as a competent witness on plans and products of Babcock and Wilcox Company.

Q But you can represent yourself as competent to say that Westinghouse hasn't taken any steps in that regard?

A To build boilers?

Q Yes.

A None that I'm aware of.

Q Okay, let's take a look at the next page of your document.

A Page 4?

Q Yes, it's labeled,"overall resource efficiencies"?

A That's the label.

Q And it says there under coal, generation 35 percent; I assume that's an efficiency figure?

A Indeed it is.

Q And then it says transmission and distribution 90 percent?

A Yes.

Q Where did you get that figure?

A That's a general figure used in the industry to approximate the losses that occur in transmission and distribution, approximately 10 percent. Now that's going to be too high in some cases and too low in others.

Q Over what period of miles, what distance in miles, is a 10 percent transmission loss computed?

A You cannot equate it directly to distance and miles; it depends on the size of the conductor, the type of equipment, the kind of load you're trying to put over it. You could lose the 10 percent, I suppose, trying to transmit a heavy load over three miles if you didn't conduct it properly.

Q Are you familiar with the conductors that are proposed to be used in the Colstrip to Hot Springs 500 kv lines?

A Somewhat.

Q Looking at that kind of configuration, what kind of line loss would you expect?

A Well, of course, we're referring there to transmission alone and only a portion of the transmission.

Q That's true.

A And I'm sure that the losses have been calculated. I wouldn't guess that they would be more than two or three percent, but here again I am not the best witness to ask this particular question of.

Q That's a fair statement.

A However, I might, if it would interest you, add that in regard to these losses, they seem to be from the best I was able to ascertain by talking to people at the Montana Power Company fairly typical of the sorts of losses we would experience on their system, 10 percent. Some I talked to theorized that it might be a little higher, some a little lower. It's difficult to put a figure on overall system loss.

Q Who at the Montana Power Company told you that 10 percent was a pretty good loss figure to use over their system now?

A I recall discussing it with Phil Beagles for one.

Q Did you talk to John Evans on that question?

A I may have; I don't recall specifically.

Q You wouldn't have chatted with anybody from the C. T. Main Company on that subject, would you?

A No.

Q C. T. Main Company, of course, is a competitor with Westinghouse in some of the branches of their activities; but that doesn't bother you, does it?

A The fact that C. T. Main is a competitor?

Q Well, you'd still talk to those folks, wouldn't you?

A Oh, on a fairly regular basis, as a matter of fact. They prepare specifications for a number of jobs that we quote on, and I'm on fairly good terms with a number of people from C. T. Main.

Q Good. Is Chet Taylor one of the fellows that you're on good terms with from C. T. Main?

A Well, I hope that Chet would consider me to be on good terms with him; I consider him to be on good terms with me.

Q That's fine. How about Gene Zobel; is he a pal?

A I don't know Gene Zobel.

Q On page 6 of your statement, Mr. Crosby, you have been talking about the uses of electricity and the efficiencies with which one can deliver electricity into homes with the use of heat pumps?

A Yes.

Q Does Westinghouse sell heat pumps?

A Yes.

Q Have you managed to persuade the Montana Power Company to mount a campaign to push the use of heat pumps in Montana?

A I'm working on that.

Q Well, I'm always interested in diligence, sir, but my question was whether you have managed to persuade them yet?

A Well, I should explain here that I'm not connected with the particular part of Westinghouse that sells heat pumps, so I'm not directly involved there in trying to persuade Montana Power to push this sort of campaign. It happens to be my personal opinion that it would be in the best interests of Montana and perhaps eventually Montana Power Company itself to do this. However, as I say, there again that's not the official representation of the Westinghouse view, only my own.

Q Well, we can underscore your view with greater emphasis, can we not, Mr. Crosby, because the data you put together persuade you rather clearly, do they not, that without the use of heat pumps, electricity is the least efficient of the energies that can be delivered to the residential consumer for heating purposes?

A I'm afraid I'd be unprepared to say it was the least efficient.

Q Well, let's take a look at some of your graphs then and see if we can figure out what they're trying to tell us.

A If we're talking about energy efficiencies, we'll probably want to refer to the graph on page 4.

Q Okay, let's do that. We have a comparison on that page of four different alternatives, natural gas, coal gasification, coal generation with heat pumps, and coal generation without heat pumps, right?

A Yes, that's true.

Q Now coal gasification, of course, is not something that is presently deliverable, is it?

A No, we had to make some assumptions about coal gasification in order to compare the chart.

Q All right, now taking a look at those alternatives which are presently available, natural gas or electricity, electricity with or without heat pumps, which is the least efficient of the three?

A If we do not consider coal gasification, the least efficient would be resistance heat with electricity.

Q That means electricity without heat pumps, yes?

A Well, no one has come up with another alternative, in addition to those two, to heat with electricity that I know of.

Q Okay, so the most efficient you think would be electricity, if you only have 90 percent transmission and distribution rather than some other figure, and heat pumps. The next most efficient would be natural gas?

A If it's available.

Q And the third most efficient would be electricity without the heat pumps, right?

A Well, again we're not considering coal gasification?

Q Well, is somebody delivering heat in somebody's home in

Montana from a coal gasification facility now?

A Not that I'm aware of?

Q Okay. Given the fact then, Mr. Crosby, that from your analysis heat pumps are vital to making electricity more efficient than natural gas, don't you think it would be a good idea to be pushing heat pumps rather hard here?

A A good idea on whose part, mine?

Q On the part of society?

A Yes, on the part of society, those that were perceptive enough to see that. Yes, I think it would be a good idea.

Q Do you know of any plans that the Montana Power Company has to do that?

A No, I do not; no, indeed. Montana Power Company, of course, is in an interesting position; they also sell natural gas, so no doubt any plans by anyone internally, or any proposal by anyone internally, to promote heat pumps to burn one particular sort of energy would have to be discussed with those who are selling the other alternative.

Q Sort of a dynamic tension within the marketing department?

A Charles Atlas would approve.

Q By the way, do you get involved in the sales through the natural gas part of the Montana Power Company's business?

A Haven't been able to figure a way to do that.

Q So you talk about electricity and how your equipment can be used to generate more of that when you deal with the Montana Power Company folks?

A Coincidentally.

Q Now let's turn to page 9 of your statement and the document that you prepared.

A Okay.

Q That's under a heading called, "substitution for natural gas used by industry"?

A Is that heading on page 9?

Q No, the heading is on the previous page.

A Okay, but we want to talk about something under that heading on page 9?

Q You got it.

A Okay.

Q It's the second paragraph on page 9 where you deal with the Anaconda Company, and you say that it recently switched one of its large copper smelting furnaces to electricity primarily to meet environmental standards. Now what made you think that was primarily to meet environmental standards?

A That's what I was informed by the people at the Anaconda Company. However, I might point out here that I should perhaps have used the word switching, that is to say they are in the process of switching now; they do not have their furnace completely up to full working capacity at this point in time, although they are in the process of getting it there.

Q Did you know, Mr. Crosby, that the Anaconda Company proposed to switch from natural gas and the configuration of equipment they used for their smelter in Anaconda to electric furnaces before they were engaged in their application for a variance from Montana's environmental standards?

A No, I'm not aware at all of the sequence of events within the management chain of the Anaconda Company.

Q Well, the term primarily to meet environmental standards, I take it, is just some editorial license that you've used?

A Oh, no, as I said earlier, when I talked to the engineers responsible at the Anaconda Company for their electric furnace, they told me that the primary reason they decided to go to an electric furnace was to meet the environmental standards which had been promulgated by the state primarily.

Q Do you know Emil Kramlick?

A Emil Kramlick? I've heard the name, I'm not well acquainted with him.

Q Do you know Mel Stokke?

A No.

Q Did you speak to either of those gentlemen on why Anaconda has switched to the electric furnaces?

A Now I might have. In my endeavors to chase this down some months ago, I talked to a number of people whose names, unfortunately, don't remain clear in my memory. Neither of those names are in my memory at this juncture.

Q Do you have any names in your mind at this juncture from Anaconda?

A Oh, let's see here. I might be able to find a name here in my notes. Yes, there's a Gordon Hercod, for example, of the Anaconda Company with whom I checked today as to the progress they were making with their electric furnaces.

Q Well, that's pretty good recall from today. How are you fixed for the folks that you talked to some months ago who told you that this was primarily to meet environmental standards?

A I can't recall the names, Mr. Shenker. However, if it's of tremendous consequence, I'm sure that we could delve into our files and find them.

Q Okay, let's turn to the next page of your statement. There you are comparing the options and problems from two possibilities, one is goal gasification, the other is electricity generation. I'm interested in your comments under the electricity generation column. Point number 3 you make is that Colstrip 3 could be operational in 1981 if construction approval is not delayed beyond the end of 1976. Where did you get that information?

A Strictly my estimate based on what I know having seen other generating plants being built, and also as a consequence of some informal conversations with Montana Power Company people. Now they might be able to accelerate that schedule and get the job done even more quickly than 1981; I don't know for sure.

Q But '81 is your guess?

A That's my best guess.

Q Based upon discussions with the folks at Montana Power and internally at Westinghouse, right?

A Not so much internally at Westinghouse.

Q More externally with Montana Power?

A Well, perhaps my own perceptions glean from sources outside either one of those two companies.

Q Okay, point number 4 I'm a little puzzled by the language. You say, "Through interconnections with other utilities and by putting older plants on standby status, large generation additions can be accommodated." What does that mean?

A Well, of course, that's in comparison with the problem that we're talking about here in reference to natural gas, or with reference to coal gas. You see if you have an isolated system, and you decide that you want to build a very large plant which would produce a significant fraction of the power, whether it be in the form of electricity or coal gas of that system, then you're faced with doing either one of two things, either waiting until there's a deficiency on the part of that system as far as serving its demands are concerned to justify putting onto line such a large plant, or putting the large plant onto line before there is the necessity for it, which makes it difficult to pay for itself. There are problems that are faced by systems that are isolated and not interconnected and by systems that don't have other older plants of this type already on the system which they could retire.

Q You don't see any other alternatives than those two?

A Other alternatives for what?

Q You just described two alternatives; one was to wait for the deficiency, the second was when you have the large plants, you have to build the large plants too early and sit for the surplus. You don't see any alternatives to that?

A Oh, I suppose we can imagine one or two, but these seem to be the alternatives that most people are faced with working on.

Q Have you thought about building a smaller plant?

A A smaller coal gasification plant you mean?

Q A smaller generating station?

A Well, yes, you could do that, but, of course as has been pointed out many times in the process of these proceedings, that's not very economic very often.

Q Well, it would involve selling a smaller turbine or a smaller boiler, I suppose, so it wouldn't be economic from Westinghouse's standpoint either?

A Oh, yes, indeed it would. As a matter of fact, we'd make out much better if the utilities would be a variety of smaller turbines rather than one large one. The cost per kilowatt goes up and, you see, we would do better that way.

Q But as between selling one smaller turbine or boiler and selling one larger turbine or boiler, you're in favor of the latter; aren't you?

A I'd sooner sell several smaller ones strictly from a commercial point of view than one large one, but, of course, you see my civic responsibility has a kind of a conflict there with my commercial concerns. Of course, my civic responsibility takes preference, or precedence.

Q And that's why you're here today, from your civic responsibility, isn't it?

A Well, it's very convenient and fortunate when one's civic responsibility tends to coincide with his commercial interests, as they do in this particular case.

Q Now I gave you a multiple choice quiz in which you chose none of the above as one of the options, and I'd like to restrict you to the choices that I gave you. If you had to sell a smaller turbine as opposed to a larger turbine, you're going to make less money, aren't you; a single smaller turbine?

A A single small turbine, generally speaking, would cost less than one large turbine, depending upon the management of that contract, Westinghouse may or may not make more money on the smaller or larger turbine.

Q It's in business to do so, isn't it?

A We don't always succeed what we're in business to do -- succeed at, I'm sorry I left that out.

Q Now at your point number 4 on page 10, you make reference to putting older plants on standby status. Do you have some nominations for older plants that should be put on standby status in Montana?

A In Montana?

Q Yes.

A Oh, the Bird plant in Billings, for example.

Q Any others outside of Montana?

A Oh, I'm not familiar with the individual plants on the systems of all of the partners, so I couldn't make recommendations as to which ones they'd want to put on standby status.

Q On page 11 of your statement, under technological maturity, the last sentence, you compare the design and construction of coal-fired electric generating stations to find that they required from 3 to 5 years; is that right?

A Yes.

Q That's based upon your own internal information at Westinghouse, contact with Montana Power Company, and whatever other diverse sources you may have?

A Yes.

Q Okay. The next section of your paper is entitled, "reserve requirements." What are the present reserves available to the Montana Power Company?

A The present reserves available to the Montana Power Company?

Q Yes, sir.

A Well, they are, of course, as has been also testified by people who are more familiar with this than I, connected to a good number of other power companies in the Pacific Northwest, and the cumulative reserve of all these power companies would be available to the Montana Power Company should they need it, if indeed the line capacity is there to carry it.

Q In your view, older plants like the Bird plant in Billings, which is the example you gave me, would be part of that reserve capacity, I take it?

A Well, of course, they have different types of reserve; there's standby reserve and spinning reserve and what not, but certainly any plants that are capable of generating power which are presently not doing so could be thrown into breech were the necessity to arise.

Q Okay. On page 12 of your statement, your special document, you list comparative environmental impact between coal gasification and electricity generation?

A Yes.

Q Again I'm interested in a couple of comments that you make under the column electricity generation.

A Okay.

Q Point 3 you say that stack gas scrubbers are approximately 99.5 percent efficient for particulates and 75 percent efficient for SO_2. Where did you get those figures?

A These are figures that have applied to the Colstrip units.

Q Oh, indeed. You think that the Colstrip units are going to be 75 percent efficient for SO_2 removal?

A Could be.

Q Could be. They could be something less or could be something more?

A Yes, I'm sure that either of those options exist.

Q Okay. Which do you think is the probability?

A I really don't know. The plants are in operation, the first two; I'm sure some results will be forthcoming pretty soon.

Q Well, if you really don't know, how did you get the figure that you put there?

A I was told.

Q By whom?

A Well, let me see now. With whom did I discuss that? I had at least one conversation with Carlton Grimm about this, possibly with Dan Berube. I can't say specifically which one of those people gave me that figure.

Q Did you have any conversation with Tim Devitt?

A No.

Q The next point that you make on page 12, item number 4, refers to a 21,000 megawatt complex. Where's that supposed to be?

A Well, there again coincidentally that is about the number of megawatts that will be generated by the first four plants at Colstrip.

Q Well, you got an extra zero in there, Mr. Crosby.

A Oh, indeed. I apologize there, a typographical error that I had not previously picked up.

Q I see. You're only talking about the 2,100 megawatts at

Colstrip?

A Two thousand one hundred megawatts that should be.

Q Yes, not 21,000 megawatts?

A Oh, we could, of course, leave the zero in there and change it to kilowatts, but let's go the other way.

Q Oh, that wouldn't quite work either; we'd have to add two more zeros.

A No, it wouldn't indeed, we'd have to add another zero, wouldn't we?

Q Yes. Under, "atmospheric impact," the next section of your statement, on page 13?

A Yes.

Q You conclude that on balance an electric generating station would have a greater atmospheric environmental impact; is that correct?

A Yes, I did come to that conclusion, yes. Now, of course, we're generalizing here.

Q I understand, but the generalization comes from the comparison between coal gasification and electric generation?

A Yes, it does.

Q So, if you were the magic planner in the sky, and you were to look down from on high, and you were to say all other factors are equal except environmental impact, you'd have to say coal gasification is a better way to go?

A I'm afraid I'd have to condition that statement by saying atmospheric environmental impact.

Q That's right. Besides atmospheric environmental impact, if all of the factors were equal, you would have to say that electric generating stations do not minimize the adverse environmental impact as much, right?

A If everything else were equal and atmospheric environmental impact were the only criterion, we would have to give a slight edge to coal gasification facilities based on what we know about them which, as you have point out earlier, is not too terribly much by virtue of the fact that not many full size facilities like this have been built.

Q Westinghouse building any?

A No. Well, wait a minute; there is a project that Westinghouse is participating in to build a gasification plant designed specifically to provide gas for a gas turbine; that is something different than pipeline quality gas which is the sort of plant that we're discussing here.

Q Page 14 of your document, there you try to give us a picture, you say, of the comparison of the amount of natural gas with the amount of generated electricity.

A Well, I worked it out in terms of days, yes.

Q Okay. Now 43,000,000,000 cubic feet per year of Canadian imports refers to what?

A Well, when I first prepared this document -- let me see here. I believe it refers, if we'll turn back there, to the amount of gas that was imported from Canada in '75.

Q By whom?

A By the Montana Power Company. No, I beg your pardon; the Canadian import was slightly less than that, slightly less than 43,000,000,000. You see, the first figures that I had to deal with when we drew these charts up were '74 figures.

Later on I tried to revise some of them to meet '75 figures, but the 43,000,000,000 cubic feet per year is the approximate amount of gas that was imported from Canada by the Montana Power Company.

Q All right, and how much of the Colstrip units 3 and 4 does the Montana Power Company have?

A Of 3 and 4?

Q Yes.

A I believe it's 40 percent, isn't it?

Q No, 30 percent, but that wasn't a bad guess.

A Well, plus or minus ten.

Q Sure. Well, in this case it's plus or minus ten which is actually plus or minus 33 and 1/3; you were off on the last percentage figure, but taking 30 percent of 1,400 megawatts, that's 420 megawatts available to the Montana Power Company, right?

A As I indicated earlier, Mr. Shenker, and it remains a physical fact, kilowatts do not go to the owners at the plant necessarily; they go where the load is, and so it's not really relevant as to who owns what percentage of that plant.

Q Well, it's relevant to Portland General Electric Company and Pacific Power and Light Company and Washington Water Power Company and the Puget Sound Power and Light Company that they intend to get 1,080 megawatts, excuse me, 980 megawatts out of the Colstrip units 3 and 4?

A I don't know what they plan to get out of the Colstrip units 3 and 4. I doubt whether they actually planned that that many megawatts would travel from those plants into their systems, but they might. It will certainly feed the general system from which they all take energy.

Q Okay. Now in order for us properly to compare the natural gas available to the Montana Power Company, which is the figure you have in the left-hand column on page 14, with generation capacity at Colstrip, should we not be comparing that generation capacity that is available to the Montana Power Company?

A No, I don't think so for the reasons that I just said. If the load is in Montana, no matter who owns the plant, in all likelihood the kilowatts will remain here because they are going to go to the closest load.

Q Well, if it were the case that Montana Power Company was only going to keep 420 megawatts available to it for average energy from Colstrip 3 and 4, you would agree with me then, would you not, Mr. Crosby, that to make a proper comparison with the natural gas importations by the Montana Power Company, you would have to use the equivalent information, that is to say, what is available to the Montana Power Company in both instances; isn't that the figure that you'd have to use?

A If, indeed, that were my intent. However, the intent here was to merely demonstrate how much electrical energy produced by plants which are being discussed a good deal by Montana Power at this time, how much of this electrical energy from these plants as a percentage of their total capacity based on a yearly output basis would be required to replace that natural gas, and the ownership of the plants, as I said again, is not relevant in this comparison. However, we could draw another comparison and make it relevant, I suppose. This is obviously what you're trying to do.

Q And you haven't done that in terms of figures, have you?

A No, I have not.

Q You'd be dealing with a substantially greater number of days necessary to operate the Colstrip plants if you were dealing with 420 megawatts as opposed to 1,400 megawatts?

A Yes, indeed. I suppose if Montana Power had any information that the Canadians were planning to cut them off very soon, they should probably try to renegotiate with their partners to get a bigger piece of these plants. However, again that's not information that I have, so I don't know.

Q Do you have any information about what the load resource picture is for the partners?

A Oh, only in a very general sense.

Q Okay. Now you point out on page 15 of your statement, Mr. Crosby, that in order to transfer from natural gas to electricity, it would be necessary to have substantial additional transmission available in Montana?

A I point out that, indeed, it would not be necessarily a simple thing to overnight switch from reliance on natural gas to Colstrip electricity or electricity period. Yes, indeed, you would need additional transmission distribution.

Q How much additional transmission would you need in Montana to convert all natural gas use to electricity?

A Do you want me to give you that figure in terms of what, miles of line, dollars worth of line?

Q Miles of line?

A I don't know.

Q Can you give it to me in any terms?

A How much additional would be required?

Q Yes.

A I have not done the study necessary to make that possible. I don't know exactly how much reserve capacities are available in the present system and, as a consequence, could not tell you since I have nothing to subtract from my total amount of transmission distribution necessary what the addition would be.

Q You conclude in your statement, Mr. Crosby, that the task force that's looking at natural gas problems these days for the state of Montana really ought to be looking at alternatives that are available to it?

A That's my opinion.

Q Yes, do you know of an agency in Montana which is charged with just that kind of responsibility?

A Well, possibly the Energy Advisory Council headed up by the Lieutenant Governor.

Q Now let's turn to the statement of Mr. Dunning.

A Okay.

Q Page 6, paragraph 3, Mr. Dunning states without any equivocation that although there are environmental limitations to the full use of coal, and it is not competitive with nuclear energy; we don't have to finish the rest of that statement for the purpose of the question I want to put to you; would you agree with Mr. Dunning and Mr. Simpson that coal is not competitive with nuclear energy?

A Is not competitive with nuclear energy?

Q Yes, that's what he says, isn't it?

A If we were going to generalize about the situation across the country, I'd have to say yes, on the average that's true. Certainly in Montana, to be more specfic, coal would be a more competitive option.

Q Well, let's turn to the next page then and see how Mr. Dunning equivocates there, if at all; I don't see it. In the top paragraph, in the second line he says nuclear energy is today the most inexpensive means of generating electric power. Don't you agree with the statement which you are putting into evidence through your own testimony?

A As a generality applied across the country, yes, indeed; in specific areas and under specific circumstances, no.

Q Now have you done that kind of study, or found somebody else's paper which did the study, which tells us what's the cheapest in Montana?

A Have I seen somebody else's study which tells me which the cheapest alternative would be in Montana?

Q Yes.

A Between the nuclear and coal?

Q Have you prepared one for us?

A Well, I have seen the results of some studies done by the power company and its partners, and I believe them when they say that coal would be the least expensive alternative. It makes a good deal of sense to me.

Q Well, in order to switch from other energy sources to the more abundant fuel, such as coal, Mr. Dunning continues in the next paragraph on that page, he says we must substitute electricity and that requires that the products and devices which actually use electricity be developed, marketed, and used where they can do the most good. Are you in favor of that?

A Oh, indeed.

Q You want to develop lots of products and markets for electricity so that the electric generating stations can have those markets, right?

A Or so that the American people can continue to enjoy the standard of living that we all enjoy today, another alternative, you see.

Q On electricity usage?

A Well, as I indicated earlier, I'm in the happy circumstance here of where civic responsibility and commercial advantage happen to coincide.

Q If you will turn to page 8 of Mr. Dunning's statement, third paragraph, he refers to what I was talking about with you earlier; industrial process steam is the largest single user of energy in the economy, accounting for one-sixth of the total. Greater use of coal and electric boilers can significantly reduce gas and oil consumption for process steam. Now you know that's true, don't you?

A Well, I believe what is said there is true; however, if I'm not mistaken, what you were referring to earlier was the use of steam to generate kilowatts for industrial purposes, and not necessarily strictly for heating purposes.

Q We were talking about both aspects and here, of course, Mr. Dunning is talking about industrial processed steam; isn't he?

A Yes, he is.

Q And he's talking about a fuel source available for industrial consumption; isn't he?

A Yes, he is.

Q And coal is one of those fuel sources available, isn't it?

A It certainly is a source available, yes.

Q Now have you looked, Mr. Crosby, to see what the impact would be by the conversion of industrial usage of coal as a fuel source in Montana on the demand for electricity?

A In a cursory sort of way; I have not done a detailed analysis of that. I have looked at the facilities around the state which I thought were of sufficient size to justify the kind of sophisticated boilers and pollution control devices that we mentioned earlier.

Q Well, as a matter of fact, Westinghouse sells a unit called the templifier, doesn't it?

A No, we don't sell it yet; it's something we developed as a prototype to see how it would work.

Q And it functions like a heat pump in order to substantially reduce the amount of energy that an industrial user would have to take from an alternative source of a fossil-fired boiler, wouldn't it?

A Yes.

Q That's a good thing to develop, isn't it?

A A very civic minded sort of thing to develop.

Q Yes, well, you are in favor or that, aren't you?

A Well, of course.

Q Now on page 10 of Mr. Dunning's statement, the second paragraph, of course, this is a statement prepared in March of 1975 so the data is limited to some time prior to March of 1975, but he states electric utilities have recently cancelled or delayed almost 200,000 megawatts of generating equipment. You knew that was true back some time prior to March of '75, didn't you?

A Well, I trust these figures.

Q Yes. Since that time do you know that additional generating capacity has been cancelled or delayed by electric utilities?

A I would not be surprised to hear it.

Q Now I suppose you're a little unhappy that folks do that when some of the cancellations and delays affect your own orders for the sales of equipment?

A Well, that is one of the reasons why the Westinghouse Corporation is unhappy about it, but as I've indicated several times earlier, there might be other reasons why I personally and the Westinghouse Corporation would be unhappy about it; and those are that if this country is short of energy, that we are all going to suffer including the employees of Westinghouse in their personal lives.

Q Well, you don't think the utilities have delayed and cancelled projects because they want everybody to suffer by having a deficiency of energy, do you?

A Oh, I don't think that their reasons were that perverse, no.

Q No. They made judgments based upon their public responsibilities, their statutory obligations, and their economic necessities; didn't they?

A Mostly on economic necessities. They were forced, in most cases, to cancel these planned additions because of the lack of financing.

Q Now at the bottom of page 10, would you accept the truism that is stated there that the manufacturing fraternity holds that an order once delayed cannot be reinstated on the original time schedule?

A Oh, that seems to generally be the case, yes. You have other orders usually that slip in and take that space. It's not always that way; occasionally you can reinstate something.

Q On the next page of Mr. Dunning's statement, third paragraph, he refers to an increase in the utilities load factor by promoting greater use of electricity during off-peak hours. Isn't that a good thing to do?

A It certainly is.

Q Is the Montana Power Company doing that?

A Well, I don't know how much they're endeavoring to do in regard to off-peak hours. I'm certain that the Montana Power Company, like any other power company, would be very happy to have more efficient use of their equipment, and would promote off-peak uses of their power and ways to encourage it, and I'm sure that this is being discussed by them.

Q You don't know if they're actually taking any steps to do that, do you?

A I only know that steps are being discussed to promote it, and I wouldn't be surprised if in specific instances, particularly in regard to their larger customers, if they don't do things to encourage this. One step that has been taken by Montana Power Company for years is to put a demand charge on the kilowatts sold to large consumers which indeed does provide them with a rather substantial economic incentive to try to burn as many of their kilowatts of power during off-peak times.

Q Well, you believe that rate structure does, in fact, have an impact upon the consumer; don't you?

A I'm sure it does.

Q That means to you, I take it, that the more the consumer has to pay, the less he wants to buy, right?

A As a generality that can be true; however, there are certain limitations upon the general applicability of that.

Q If you would turn to the first appendix to Mr. Dunning's statement, page A-1; the kind of format of the statement is that the first portion prior to the appendix, which is some 15 pages long, treats with a number of subjects each of which is then treated in slightly more detail in the appendix that follows, right?

A Yes.

Q In Appendix A there's a quotation from M. King Hubbert of the U.S. Geological Survey who, according to Mr. Dunning, has done some excellent work on quantifying energy supplies. You'd agree with that, wouldn't you?

A That his work is excellent?

Q Yes, sir.

A Well, having not had an independent opportunity to examine his work would probably be inclined to go along with Mr. Dunning in this regard based upon my experience with Mr. Dunning as a pretty reliable source of this sort of information.

Q Well, you've heard of Mr. Hubbert before, haven't you? He is a rather noted authority?

A I've heard of him.

Q Yes. You would agree with Mr. Hubbert's statement that's previously been submitted in evidence, would you not, that it is as true of power plants or automobiles as it is of biological populations that the earth cannot sustain any physical growth for more than a few ten's of successive doublings. Because of this impossibility, the exponential rates of industrial and population growth that have prevailed during the past century and a half must soon cease. Although the forthcoming period of stability poses no insuperable physical or biological difficulties, it can hardly fail to force a major revision of those aspects of our current social and economic thinking that stem from the assumption that the growth rates that have characterized this temporary period can somehow be made permanent. You'd agree with Mr. Hubbert on that, wouldn't you, sir?

A Well, of course, you have taken Mr. Hubbert's statement out of context, and I haven't had a chance to study it in the context in which it was originally written. However, I would go this far. I believe that it would certainly be to the advantage of the United States and the other countries in the world if we could level off the population growth and the demand for the resources that is going to be required and, as a matter of fact, the trend, and I'm not sure whether that particular graph is in this appendix or not, the trend in regard to the growth of the U. S. labor force seems to have just about peaked out and if the projections continue, somewhere around the year 2000 we will be approaching zero, and at that point in time, we should be able to let our GNP and corresponding demand for energy fall off somewhat, too. However, we need to look forward to the next 10 to 15 to 20 years when the growth of the labor force is already, I'm afraid, forced on us by the fact that the people who are going to be coming into it are already born.

Q Do you know what the date of the statement was that I just quoted to you, sir?

A The one by Mr. Hubbert?

Q Yes.

A No.

Q All right. If you would turn to Appendix J, that's the last appendix in the document prepared by Mr. Dunning, and it's sort of an outline statement of what the recommendations are that were submitted on behalf of Westinghouse by Mr. Simpson in his congressional testimony, correct?

A Well, I assume that Mr. Simpson submitted these, yes, as well as Mr. Dunning had occasion at several forums to submit them himself, but go ahead.

Q In Appendix J, page J-3, it's an item entitled, "residential and commercial energy use" where recommendation 3.3c is, "prohibit new central air conditioning installations except by heat pumps." Would you go along with that recommendation in the evidence that you've tendered?

A I might be disinclined to prohibit; I would encourage, perhaps is the word I would substitute for prohibit there; I don't like prohibitions.

Q Well, then let's look at encouragement on the last page, J-5, "industrial energy use"; the first recommendation, item 5.1, says encourage substitution coincident with encouragement of conservation. Are you in favor of that?

A Indeed I am.

Q Now I notice that in these recommendations, the Westinghouse Corporation through Mr. Simpson through Mr. Dunning also does not address itself to the merits of load center generation versus mine-mouth generation. Can you tell me why that's the case, sir?

A Here again the primary topic for study of these people was how much energy is going to be required in this country, and what's the best way of providing this energy to the country, and that particular question is really not too terribly germaine in that kind of an analysis, except to the extent that we said earlier one should try to conserve his resources including his kilowatts wherever possible.

MR. SHENKER: Okay, Mr. Crosby, thank you very much. I have nothing further at this time.

HEARINGS EXAMINER: Thank you, Mr. Crosby, and Mr. Schwennesen, come right on up, sir, and as I promised, if we have to stay here all night, we're going to take care of you.

DON SCHWENNESEN, appearing as a public witness, having been first duly sworn upon his oath, was examined and testified as follows:

HEARINGS EXAMINER: Would you state your name and your address, please?

WITNESS: My name is Don Schwennesen and I reside at 440 Eddy Avenue, Missoula, Montana.

HEARINGS EXAMINER: And, Mr. Schwennesen, you appear as a proponent or opponent?

WITNESS: I appear an an opponent.

HEARINGS EXAMINER: Very well. The reason I ask you that is so we know who will cross-examine. Very well, go ahead and make your statement, sir.

STATEMENT OF DON SCHWENNESEN

Thank you for the opportunity to testify here today. I do not envy you board members your decision nor do I take your decision lightly. My testimony today is in opposition to the proposed development of the Colstrip 3 and 4 generating units. My remarks will address the general question of need. While the Montana Power Company today imports some of the electricity it markets within the state, as it imports natural gas, I understand that as a state Montana is a modest net exporter of electricity. We are a large state, well endowed with resources. Doubtless we have an obligation to share our resources with the nation and the world, but a balanced sharing is in order rather than an exploited sharing through which Montanans sacrifice profits in other regions.

The sacrifice of Montana's valleys and watersheds to produce hydroelectricity for export represent a not inconsiderable past sacrifice. Coupled with oil and gas production, and now with large-scale coal strip-mining, it produces a portrait of a state shouldering a fair and ample share of the energy crisis burden. Testimony given thus far in the hearings suggests that based on past and current trends, Montana and the Pacific Northwest could run short of electricity by the early 1980's. The projections trouble me less than the trends, however.

The issue at Colstrip, indeed, is not the possible future shortage, but the use trend of the past two decades or longer. In the past we have made large natural resource commitments to the notion that cheap and abundant energy would improve our collective lot. No one would dispute that much has been improved, but improvement has not come without some sacrifice of both resources and quality of life.

World petroleum reserves are headed toward exhaustion, and one may only hope that future generations with problems yet unimaginable will not have cause to rue our profligacy. Yet there are those who argue seriously that we ought to go on and do the same with our coal, asserting that cheap energy will promote growth in technology that will, in turn, answer all the problems of the future.

It is clearly time to reevaluate this energy growth philosophy for both its strengths and its weaknesses. The time is now at Colstrip 3 and 4, not later on when similar projects are advanced on the strength of 1976 precedence; and there are a host of weaknesses, or at least inconsistencies, in our present social patterns that must be dealt with before we move hastily into a renewed era of cheap energy.

Many corporations show signs today of being locked into a vicious spiral in which continued corporate growth is essential to corporate survival even though it may run counter to the best interests of the society as a whole. It does not surprise me that future growth in electricity use is projected to be high in the Pacific Northwest states to the west in light of the fact that residential electricity rates in those areas are substantially lower than ours in Montana.

If my own residential rates were halfed, I suspect that I could find some more uses for home electricity. Declining block rate structures neither benefit the lower income levels of our society nor promote efficient use of energy at the higher use levels.

Rural electric cooperatives, for years the beneficiaries of some of the cheapest energy, were constituted in recognition of the importance of food and agriculture to our nation and to the world order. Yet today we find this cheap energy so important to irrigation and production finding widespread use also in rural subdivisions whose occupants not only flee the urban social costs and problems, but carry those problems with them to the farm lands which go out of production as a result. Yet their homes are often the beneficiaries of coop electricity so cheap that electric heating is an irresistible option.

Cheap energy, once the key to a future free from the drudgery of human labor, has also proved a mixed blessing. The dream was that energy technology would replace drudgery jobs with better, more challenging technological jobs. Instead, we find in retrospect that cheap energy has been used in many quarters simply to minimize human labor and labor costs. The result is plain in the form of increased unemployment and welfare costs that seem to permeate all social strata, from the lowest laborer to the college graduate, with those suffering most who are least able to find retraining and adapt to some new role in a technological society.

Shipping coal west instead of electricity might do something to alleviate this kind of problem. In addition to creating new railroad jobs, it might enhance railroad income, improve track maintenance, and thereby, indirectly, improve Amtrak mass transportation service.

Technology is surely the key to our survival in the future. It is our application of that technology for best results that must be of greatest concern. I see no reason why the state must rush now to become a mainstay of fossil fuel generation in the northwest with a generating facility far from the main load sources, thereby committing a rather remote and environmentally pristine region to a coal burning technology that may appear rather primitive within a matter of a very few short years.

We have not made efficient use of energy in the past. New methods such as fluid bed combustion are in the news with increasing regularity. New pollution controls are evolving with rapidity. It may be more prudent for us to concentrate on building smaller plants in or near urban areas where waste heat can be used in space heating as it is today in Berlin and elsewhere in Europe.

Long distance transmission lines do little to enhance the state's aesthetic appeal in a time when the nation is turning more and more to places like Montana to meet recreational needs. Driving over to Helena today along the Clark Fork River, I counted no fewer than 11 rights of way along the narrow valley near Rock Creek -- the interstate, a frontage road, two railroads; and no less than seven overhead lines of varying size.

At Beaverhead Hill on a spur above I-90, there were no fewer than 16 single and double tower utility poles supporting various wires within an area the size of a football field.

Surely we must begin to have more care for the beauty of our land. In the Swiss and Bavarian Alps of Europe where I was privileged to visit while stationed in Germany as an Army officer, I submit such things would not be permitted. Technology has been welcomes in Europe mountain areas, but as a polite partner of the environment, not as a replacement for it.

Colstrip is symbolic as a bellwether for future trends in Montana. While I do not criticize or condemn Montana Power and affiliates for proposing the Colstrip development, I suggest that it is a development cast in the traditional mold, and one lacking in fresh creative approaches to energy needs and energy use.

Approval of Colstrip 3 and 4 will make it more difficult to change the direction of energy development and consumption in the future. Denial or deferral of this project pending further advances in technology and in public philosophy toward power would be a long term service to the state on the part of this Board.

HEARINGS EXAMINER: Very well. Mr. Bellingham will be permitted to ask you some questions on cross-examination.

MR. BELLINGHAM: Did you say a few?

HEARINGS EXAMINER: No, I didn't have any quantification or qualification.

EXAMINATION OF DON SCHWENNESEN

Cross, by Applicants

By Mr. Bellingham:

Q Mr. Schwennesen, how old are you?

A I am 33.

Q For whom do you work?

A I'm a newspaper reporter for the newspaper in Missoula, Montana.

Q What is the name of it?

A The Missoulian.

Q And that is one of the leading newspapers?

A Yes, it is.

Q How long have you worked for that paper?

A About three years; a little over three years.

Q Are you a graduate of the University of Montana journalism school?

A I did graduate work there, and I'm in the process of writing a thesis for the masters degree.

Q Where did you graduate from?

A Trinity College in Hartford, Connecticut.

Q In journalism?

A No, sir.

Q You're not a journalism graduate, I take it?

A No, sir.

Q And what do you do for the Missoulian?

A I do general assignment reporting, a certain amount of environmental reporting.

Q What do you mean a certain amount of environmental reporting?

A Well, for example, when the Colstrip plant was first proposed, some of the initial environmental impact statements came my way for news stories prior to the time that the AP and our state bureau began exclusive coverage of these kinds of topics. I've also written stories on the Hoernor-Waldorf expansion in Missoula, on the U. S. plywood mill there, on the air and water quality in the area; but in addition to that, I've reported on forest service affairs, on county government, and a number of things that would not normally be construed to be environmental problems.

Q Well, you're a day-by-day reporter on the staff; is that right?

A Yes, sir, that's right.

Q Full-time job?

A That's right.

Q Do the Missoulian officers know that you're here today?

A No, they don't.

Q You're not speaking on behalf of the daily Missoulian?

A No, sir; I'm speaking as a private citizen.

Q You're not under their sponsorship at all?

A No, sir.

Q Were you contacted by anyone relative to coming here in the first place?

A No, sir.

Q Have you previously written any articles against Colstrip 3 and 4 for your paper or for any other publication?

A I don't believe I have, sir, no.

Q Now you talk about Montana Power imports, and Montana as a whole exports; are you aware of the fact that Montana Power for many years imported from out of state approximately 20 percent of its electricity needed in this state to service its service area? Are you aware of that?

A I have a hard time keeping the figures clear in my mind, but I wouldn't be surprised at that.

Q You talk about the shortage of coal and other natural resources; are you aware that estimates have been made that we have enough coal in this country to last us up to 500 years?

A Yes, sir, and there have been estimates made that the coal may not last 100 years either. I think the estimates depend on what types of growth projections underlie them.

Q Well, it depends on the estimater also, does it not?

A I wouldn't be surprised.

Q But you are aware of that figure of 500 years; have you seen that?

A I've seen that figure, yes.

Q Now you talk about alternate as shipping coal to the Pacific Northwest; of course, you've made no studies regarding this point I'm sure, have you?

A None of my own, no, sir.

Q You've read what others have said regarding this?

A That's right.

Q You know, of course, that there's no certainty that Montana is going to ship coal to the Pacific Northwest?

A I know that.

Q Pardon?

A I know that.

Q Its coal is now being shipped to the east and to the south; you're aware of that?

A That's right. There have been some test shipments that have gone west through Missoula. If there are any contracts for shipment west, they would be fairly recent and I'm not aware of them.

Q Well, I think the evidence is that there aren't any now, so the fact that we may or may not ship, or the fact that we may ship coal in the future to the Pacific Northwest is problematical at the most; I assume that you agree with that?

A Well, I think that one could predict with a certain amount of reliability that we could anticipate coal exports to the west within the next few years.

Q You haven't made any studies concerning this?

A No, I haven't.

Q What about coal for use in generating plants in the Pacific Northwest; have you prophesied that we may be doing that in the future?

A I think that there's a fair possibility that we might. There is coal in the Pacific Northwest to be sure. However, if I'm not mistaken, our supplies in this area are considerably larger than those over there.

Q Well, are you aware of our sulfur content in Montana coal as compared to Wyoming coal?

A It's been a subject of considerable debate. Some believe that our coal is quite low in sulfur; others contend that some of our coal is quite low in sulfur, but most of it when the sulfur content is weighed against the BTU content, the net result is not as favorable as one might hope.

Q Well, let's go into the possibles of coal shipments to the Pacific Northwest. Assume that they may come about eventually, although this is by no means certain. Now what's going to happen when we put unit trains on our tracks and start shipping coal? What towns are these unit trains going to go through; do you know?

A Well, I would expect that they would follow the southern route, possibly through Helena since the track is better maintained through Helena.

Q Well, let's start at Colstrip and go east, or west rather, shall we?

A Oh, boy.

Q Well, we'd go through Billings, wouldn't we?

A I think so.

Q Laurel?

A Yes.

Q Livingston?

A Yes.

Q Helena?

A I believe so.

Q Or Butte perhaps?

A Well, they could go through Butte if the track was upgraded.

Q Missoula?

A Yes.

Q And further west, is that right?

A That's right.

Q And these unit trains are going to go through, right through I should say, the middle of these towns, aren't they?

A Yes, I don't know if I could say they go right through the middle of them anymore, they might have once.

Q But they're going through parts of the town anyway, aren't they?

A Yes, that's right.

Q And this is going to cause a certain amount of consternation as far as the local people are concerned, don't you imagine?

A I suppose it may cause consternation among some.

Q And traffic flows are going to be interrupted, of course?

A What kinds of traffic flows?

Q Traffic flows of automobiles?

A Well, I think in most cases, in many cases at least, these traffic flows already occur.

Q Well, this addition of unit trains is not going to help the traffic flow, is it?

A I was under the impression that a number of the unit trains also run at night.

Q Well, that may be true, but if we assume that a lot of them are going to run in the daytime, it's not going to help the traffic flow, is it?

A Well, in Missoula, let me see; I can think of one crossing, one rail crossing, where it would cause consternation to have trains, a greatly increased number of trains, passing through regularly. I think most of the rest of the crossings are bridged at this point.

Q What about Billings? Are you aware of how many crossings down there that it might impede?

A No, I'm not. How many are there?

Q There are quite a few, more than there are in Missoula, I can assure you of that. What about the increased use of diesel fuel or oil to propel these trains? That cuts down the natural resource, doesn't it?

A Yes, it does.

Q And utilizes it?

A Yes, it does.

Q One that's in very scarce supply today in the United States, as we know, doesn't it?

A Apparently, from what I've read.

Q Yes. What about the trains and the pollution of the atmosphere? They're not going to certainly help the atmosphere, are they, as they chug through these towns?

A Well, diesel engines are supposed to be relatively efficient in this regard.

Q That's right, they are, but they certainly don't enhance the atmosphere, do they, as they go along?

A Probably not.

Q Yes. You talk about 3 and 4 being the bellwether; you're familiar with the Utility Siting Act, are you not?

A Yes, I am.

Q Have you read it?

A Yes, I have.

Q You are aware, of course, then that each individual application for power generating plants is going to have to be decided upon on its own?

A That's right, a very favorable rule.

Q The board is going to have to consider each one individually, isn't that right?

A That's correct.

Q Well, don't you think that 3 and 4 should be considered on its own merits?

A Absolutely.

Q Distinct from any future applications that may take place?

A Absolutely.

Q Yes. And don't you think that any future applications for generating plants, or for any other kinds of plants utilizing coal should be also considered on their own merits?

A Certainly.

Q Without any consideration to what may or may not have happened as far as 3 and 4 is concerned?

A Well, I think when you consider each new application, you cannot help but consider it in light of your present position with regard to the past and the future. When you consider any new development, of course you are considering that development for what it offers in the way of costs and benefits.

You are also trying to determine whether this particular project fits into the future course of the society that you're building.

Q Well, let me ask you this. The fact that 3 and 4 is granted, assuming that fact, should not it in of itself influence the deliberations of any board in the future relative to future plants, should it?

A I don't think I quite understand your question.

Q Well, assuming that in this case 3 and 4 is approved, you don't think that that per se should influence any future board in its deliberations of future plants, do you?

A Not per se, but in light of the performance of that kind of a plant, I don't see that it could help but influence the board in the future.

Q Well, don't you think that if we go back to the Siting Act that each individual plant should be decided upon on its own merits, basically?

A Well, again I don't understand the question. If a new plant is considered, the new plant is considered in light of existing technology and the performance of that technology. Therefore, it's impossible to consider a new plant in a vacuum without looking at what's going on in the industry.

Q Well, let's move this along. As far as alternatives are concerned down the road, you talk about alternatives here like everybody else that comes in and opposes these plants. Do you know what we're talking about in terms of time as far as alternatives are concerned?

A In terms of time?

Q Yes.

A Well, I thought about that.

Q I'm sure you have.

A And I think that the actual time to bring a plant on line could probably vary from anywhere from as little as 2 or 3 or 4 years up to a good many years depending, in part, on whether the public was enthusiatic about what the proposal was.

Q Do you know what the time frame of units 3 and 4 is considered to be based upon present estimates?

A I'll be honest with you, I can't remember; but I believe they were going to be on line in the early '80's.

Q Well, do you know how long that has taken, assuming that they are built in the early '80's, '80 and '81 let's assume, do you know how long they've been working on these particular plants?

A Well, let me see. I think I first heard of them two or three years ago.

Q So we're talking about a term here of nine years or so, aren't we, very possibly?

A Well, we're also talking about a new law, and we're talking about a wrenching societal change in the way we consider these kinds of projects. I think that Montana Power and the affiliates who have proposed Colstrip 3 and 4 perhaps suffer because they're the first to go through under this new law. However, I'm not sure that the delays in this case have been shown to be critical to the supply of power in the future.

Q You don't? Well, you haven't read the transcripts, have you?

A Very few of them; I haven't been able to get too many of them.

Q Well, have you read any of them?

A Yes, I have.

Q Which ones have you read?

A I can't recall off-hand.

Q No, I'm sure you can't. Where did you obtain your transcripts?

A I obtained a number of them from the Northern Plains Resource Council, and I obtained a number of them from Sam Reynolds, who is our editor.

Q I see.

A I don't know where he got them.

Q Sam Reynolds, the editor of the daily Missoulian?

A Yes.

Q And you haven't attended these sessions I assume?

A No, I haven't been able to.

Q Say that these plants are not allowed to go on line, and we have a shortage of electricity, say in the late '70's or early '80's, how would you suggest that we handle the matter of who gets the electricity that is available?

A Well, I'm not sure that it would come to that, frankly. Certainly Montana Power Company has proposed to raise rates, and I think that raising the cost of energy is something that we're going to have to put up with in the future. I think that utilities could consider, as I think I indicated in my testimony, reforming the present block rate structure to encourage better use of energy by people who perhaps don't pay so much attention to energy conservation. I think also it's quite clear in the Missoula area that a number of the large manufacturing concerns are keeping their options open. The Champion International Mill there and the Hoerner-Waldorf Mill, and also the Van Evans Mill either have or plan to construct in the near future a sort of multi-purpose very large boilers to produce production steam. In the case of Champion and Van Evans, these, of course, have more to do with natural gas than they do with electricity. These particular mills aren't great users of electricity. Hoerner-Waldorf uses quite a bit.

Q Do you remember what I asked you a little while ago?

A Yes, how would I propose to alleviate the shortages?

Q No, how would you propose to allocate it, the electricity, in the event of shortage?

A Well, I think that that's a kind of an unfair question that signifies the attitude that troubles me. It doesn't seem that we as a society and as a capitalistic society led by corporate businessmen are really exploring all the options to answer a question like that. I get the feeling sometimes that it's proposed that we will do this and if we don't do this, then the public be damned. I hope that's not the case.

Q You say capitalistic society led by businessmen, is that right? That's your belief, is it?

A Oh, absolutely, I think so.

Q You'd like to see a change, I assume, wouldn't you?

A No, I'm very much in favor of the capitalistic system.

Q Led by businessmen?

A Yes, sir.

Q The way it is now?

A The way it's led by some businessmen now; I'm not saying that -- well, every time I pick up a copy of Fortune Magazine, it's apparent to me that there are mistakes being made at the high levels of the corporate business world just as there are in government and in the newspaper business, for that matter.

Q Well, do you have any recommendations for changing this system?

A I don't know that I could give them to you right now in a finished, developed form. I think I've suggested some of them in my testimony.

Q Well, what if we do have an electricity shortage. Do you know what's going to happen as far as allocation is concerned? Do you have any ideas on that subject?

A Well, again I don't see that we're going to come to an electricity shortage as we're going now if Colstrip 3 and 4 are not built.

Q Excuse me, I've asked you if you would please assume that we might; what then? Do you have any ideas?

A It would be a difficult question for me to answer.

Q Fine. You talk about rural electric coops and the cheap electricity rates?

A Yes.

Q You're not objecting to that, are you?

A Not for farmers, no.

Q You distinguish between farmers and other people, is that right?

A That's right.

Q Yes. And you talk about labor and this sort of thing; you're not suggesting that we go back to manual labor again, are you?

A No, not in the sense that we knew it a hundred or two hundred years ago.

Q You wouldn't suggest doing away with labor saving devices, would you?

MR. SHENKER: Just a moment, just a moment. The witness has several times tried to complete answers, and the questions haven't permitted the completion of the answers. I'm interested in hearing the full question and the full answer.

Q Well, Mr. Schwennesen, have I cut you off of any answer here that you'd like to expound on? If I did, I'm sorry. Can you think of any right now?

A Well, one thing that had occurred to me was that in certain industries that we have now, it appears that we are going to have to be labor intensive in the future; and I'm talking about certain types of forest industries, particularly thinning of very young trees. So in that regard, there certainly seems that there will be a need for manual labor in the future to perform some tasks, perhaps partially aided by things like chain saws. That doesn't have any bearing on electricity though.

Q Well, fine, but that doesn't have any bearing on my question at all, does it, really? I'm talking about the fact that do you recommend we substitute labor saving devices through the use of labor itself?

A Well, perhaps in some cases.

Q What cases?

A I would be hard pressed to give you any right now. For example, I've never felt the need or desire to buy an electric tooth brush, although I realize an electric tooth brush doesn't use very much electricity.

Q You mention Northern Plains Resource Council; you've had contacts with them from time to time, I assume?

A Oh, yes.

Q And they've helped you in writing your stories, furnished you information that you could utilize, this sort of thing, I assume?

A Well, they've furnished me information, yes, and Montana Power Company has furnished me information, too.

Q And are you a member of the Northern Plains Resource?

A No, I'm not.

Q But you have had contacts with them?

A Yes, I have.

Q Immediately prior to coming here to testify, have you?

A Well, I met a couple of them out in the hall.

Q We talk about technology advances; would you put nuclear power plants in that category?

A Yes, however, I guess I would tend to have misgivings toward them similar to those expressed by Dr. George Kisteokovsky, whom I interviewed when he was in Missoula last month, I believe it was. His feeling, and I think he can document it quite abley, is that the development of nuclear power plants is proceeding now about as fast as it ought to be proceeding, but there are a number of problems that are still to be resolved, and that it might be unwise for us now to make a massive commitment to this type of energy.

Q Well, I assume then that you would believe in a moratorium now as far as nuclear power plants is concerned until we take care of any of these problems that this particular doctor that you mentioned, whom I'm not familiar with --

A He was a presidential advisor to Eisenhower a number of years ago.

Q Do you agree that perhaps we should hold off on any nuclear power plants at that time until these problems which may exist are taken care of?

A Well, the fact of the matter is there are a number of them that are being built, or have been approved for construction. I think that the moratorium that's being proposed now in the western states would apply to the approval of future plants, pending the outcome of the ones that are now being built.

Q And you gc along with that approach, I assume?

A Well, I'd like to see it on the ballot. I haven't heard it discussed thoroughly yet.

Q You mean on a Montana ballot?

A Yes.

MR. BELLINGHAM: No further questions.

HEARINGS EXAMINER: Very well, sir. Do you have anything else you wish to add? We're sorry to keep you waiting so long. We're happy that you came and testified.

(WITNESS EXCUSED)

HEARINGS EXAMINER: If there is nothing else, we will recess until 9:00 A.M. in the morning.

(RECESS AT 6:37 P.M.)